

Service Manual

COMPACT
disc
DIGITAL AUDIO

DIGITAL

Compact Disc Player

SL-PJ24A

Color

(K)... Black Type



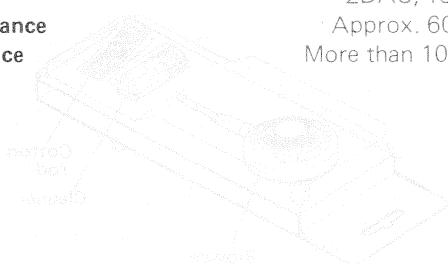
Area

Country Code	Area	Color
(E)	Continental Europe.	(K)
(EB)	Great Britain.	(K)
(EG)	F.R. Germany, and Italy.	(K)

SPECIFICATIONS

Audio

No. of channels	2 (left and right, stereo)
Frequency response	2–20,000 Hz $\pm$ 0.5 dB
Output voltage	2 V (at 0 dB)
Dynamic range	96 dB
S/N ratio	96 dB
Total harmonic distortion	0.005% (1 kHz, 0 dB)
Harmonic distortion	0.003% (1 kHz, 0 dB)
Wow and flutter	Below measurable limit
DA converter	2DAC, 18-bit
Output impedance	Approx. 600 Ω
Load impedance	More than 10 k Ω



Pickup

Wavelength	780 nm
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General

Power supply	
For Great Britain:	AC 50/60 Hz, 240V
For others:	AC 50/60 Hz, 220V
Power consumption	13 W
Dimensions (W x H x D)	360 x 96 x 280 mm
Weight	3.4 kg

Specifications subject to change without notice.
Weight and dimensions shown are approximate.

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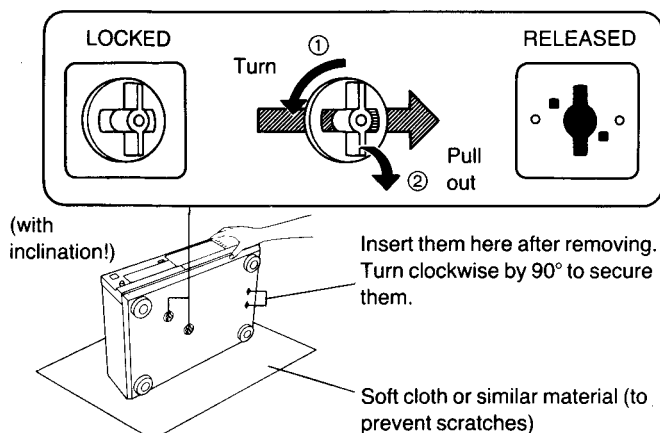
Panasonic

Matsushita Electric Industrial Co., Ltd.
Central P.O. Box 288, Osaka 530-91, Japan

■ PLACEMENT

Before placement

Two transport security devices are secured to prevent the optical pickup from damage during transport. Be sure to release them before use.



Note:

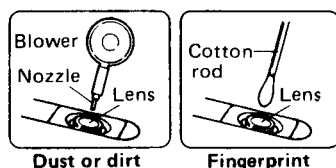
When transporting the unit, be sure to remove the compact disc from inside the unit. And replace the transport security devices again following the reverse order not to damage the optical pickup. (Make sure to place the unit with the rear panel facing downward.)

■ CLEANING OF LENS

If the lens is stained causing sound skip or operation failure, open the top cover by pressing the open button, and clean the lens.

• To remove dust or dirt

Blow the lens with the blower provided in the cleaning kit to remove dust or dirt.



• To remove fingerprint

If the blower is not enough, moisten the cotton rod with the lens cleaner solution and wipe the lens with it from center of the lens to outside.

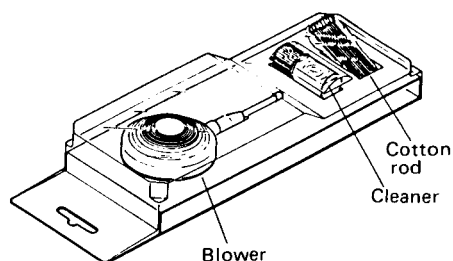
Notes of placement

- Place on a flat, level surface so that the front-rear inclination does not exceed 5°.
- Avoid places such as the following:
 - Near any equipment or device that generates strong magnetism.
 - On any heat-generating equipment or device, or in any place where the temperature is high (40°C or higher).
 - Extremely cold places (5°C or below).
 - Near a tuner or TV (It may cause noise in the broadcast, or disturbance of the TV picture.)
- Do not place heavy objects, other than system components, on top of the unit.
- When carrying or storing the unit, handle it with care so it is not subjected to any strong bumps. Always remove the disc before storing the unit for any period of time.
- To avoid problems due to vibration.
 - Do not place a book or similar object under this unit.
 - Do not route the connection cables (of this or other units) across the operation panel, across the top, or under the unit.

Cautions:

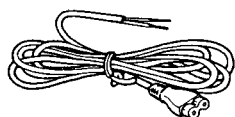
- Do not directly apply the cleaner solution to the lens. Do not apply too much solution to the cotton rod or otherwise the solution will flow into the player.
- Wipe the lens carefully. Do not give too much stress to the lens or otherwise it may scratch the lens or cause optical pickup trouble.
- If the solution should be too much applied, wipe the lens with a dry cotton rod.

Lens cleaning kit (Part No. : SZZP1038C)

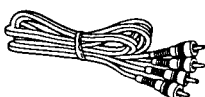


■ ACCESSORIES

- AC power supply cord ... 1
- SJA187 (E, EG)
- SJA193 (EB)



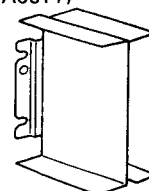
- Stereo connection cable 1
- (SJP2249-3)



- L-type cable 1
- (SJP2257T)



- Cabinet extenders 2
- (RFA0011)



■ PRECAUTION OF LASER DIODE

CAUTION: This product utilizes a laser diode with the unit turned "on", invisible laser radiation is emitted from the pick up lens.

Wave length: 780nm

Maximum output radiation power from pick up: 100μW/VDE

Laser radiation from the pick up lens is safety level, but be sure the followings:

1. Do not disassemble the optical pick up unit, since radiation from exposed laser diode is dangerous.
2. Do not adjust the variable resistor on the pickup unit. It was already adjusted.
3. Do not look at the focus lens using optical instruments.
4. Recommend not to look at pick up lens for a long time.

ACHTUNG: Dieses produkt enthält eine laserdioden. Im eingeschalteten zustand wird unsichtbare laserstrahlung von der lasereinheit abgestrahlt.

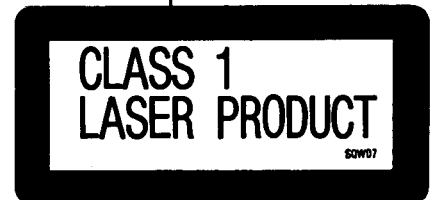
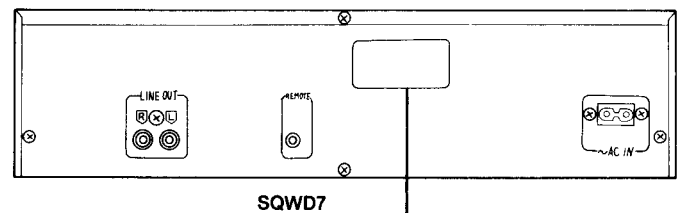
Wellenlänge: 780nm

Maximale strahlungsleistung der lasereinheit: 100μW/VDE

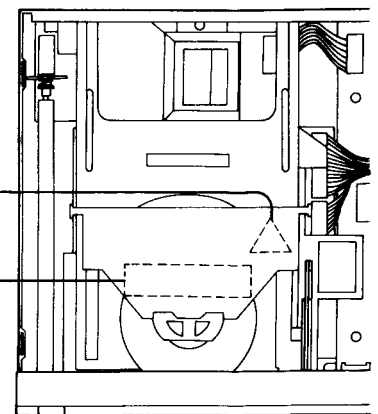
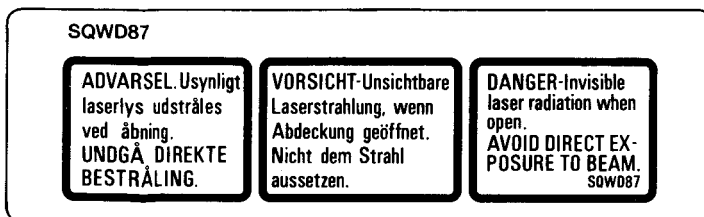
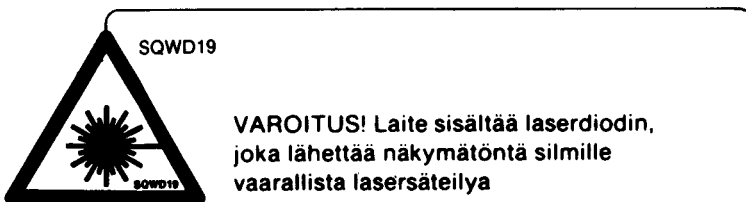
Die strahlung an der lasereinheit ist ungefährlich, wenn folgende punkte beachtet werden:

1. Die lasereinheit nicht zerlegen, da die strahlung an der freigelegten laserdioden gefährlich ist.
2. Den werksseitig justierten einstellregler der lasereinheit nicht verstellen.
3. Nicht mit optischen instrumenten in die fokussierlinse blicken.
4. Nicht über längere zeit in die fokussierlinse blicken.

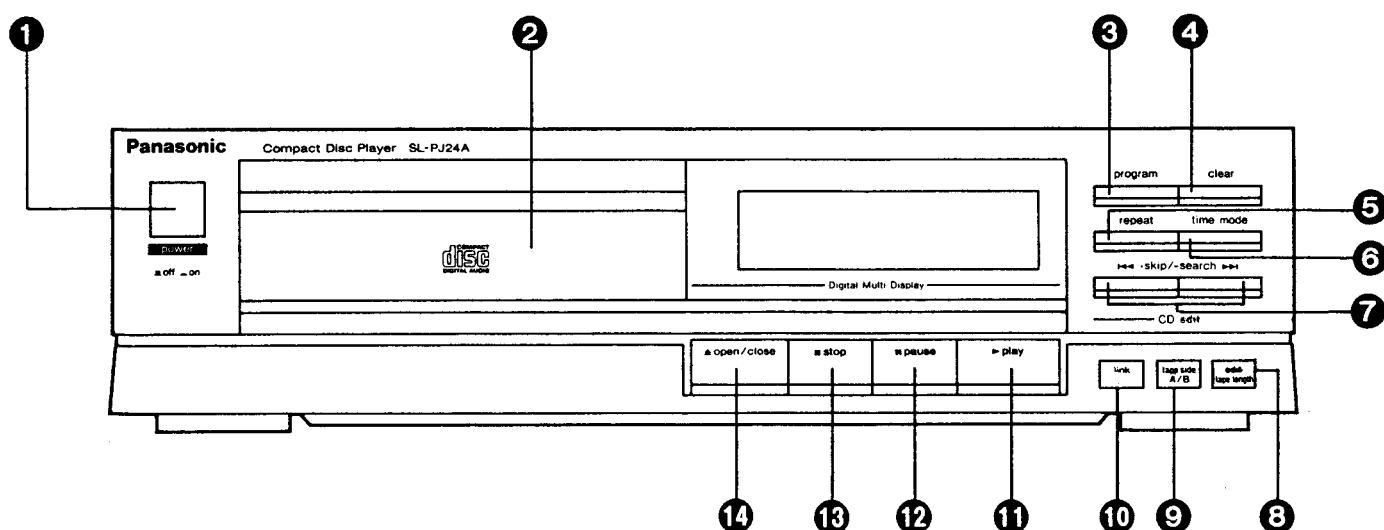
ADVASEL: I dette a apparat anvendes laser.



Obs:
Apparaten innehåller laser
Komponent av höger laserklass
än klass 1.

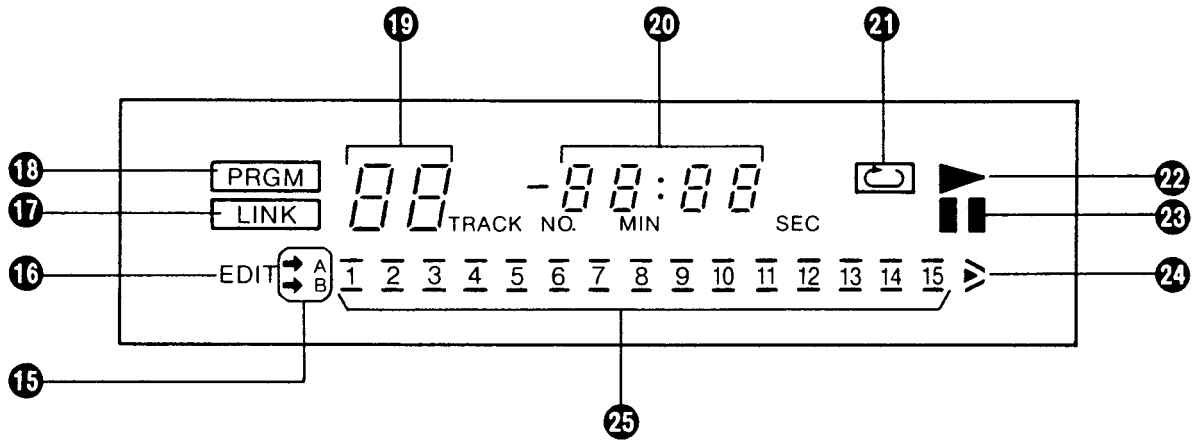


■ LOCATION OF CONTROLS



Control section

- 1 Power switch (power)**
- 2 Disc holder**
- 3 Program button (program)**
Pressing this button initiates the programmed play mode. You can then enter specific tracks using the skip/search buttons.
- 4 Clear button (clear)**
This button can be used to clear tracks from the programmed sequence one at a time.
- 5 Repeat button (repeat)**
- 6 Time mode select button (time mode)**
Use this button to select the desired time display mode.
- 7 Skip/search buttons (◀◀-skip/-search ▶▶)**
- 8 Edit tape length button (edit/tape length)**
This button is used when recording from a compact disc. When the button is pressed and the tape's length is specified, the tracks to be recorded will be automatically selected.
- 9 Tape-side select button (tape side A/B)**
When recording compact discs to tape, this button can be used to check the number of tracks and amount of tape left over for side A or B.
- 10 Link button (link)**
This button is used when edit-recordings are made from several compact discs.
- 11 Play button (▶ play)**
- 12 Pause button (⏸ pause)**
- 13 Stop button (■ stop)**
This button can be used to stop the disc play, as well as to cancel the various play modes.
- 14 Disc holder open/close button (⏏ open/close)**

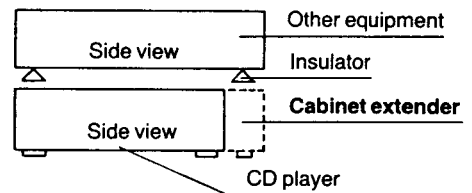


Indicators section

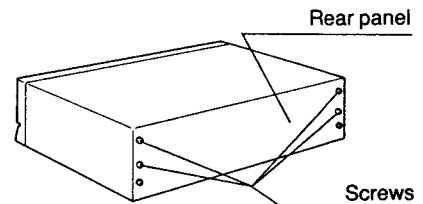
- 15 Tape side indicator (A/B)**
Illuminates to show which cassette side, "A" or "B", has been selected with the tape-side select button.
- 16 Edit indicator (EDIT)**
Illuminates when the edit tape length button is pressed and goes out when the stop button is pressed.
- 17 Link indicator (LINK)**
- 18 Program indicator (PRGM)**
- 19 Track number display (TRACK)**
- 20 Time display (NO./MIN/SEC)**
- 21 Repeat indicator (REPEAT)**
- 22 Play indicator (▶)**
- 23 Pause indicator (||)**
- 24 "Over" mark (⏮)**
This indicator lights if the total number of tracks on the disc is 16 or more.
- 25 Music matrix (1~15)**
The numbers of the tracks on the disc are displayed up to a maximum of 15.

To use the cabinet extenders

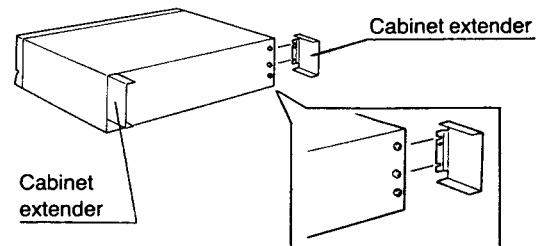
If other audio equipment placed on this unit is too large (i.e., the back insulators do not rest on this unit), affix the cabinet extenders to the rear panel.



1. Loosen the four screws.



2. Secure the cabinet extenders using the four screws.



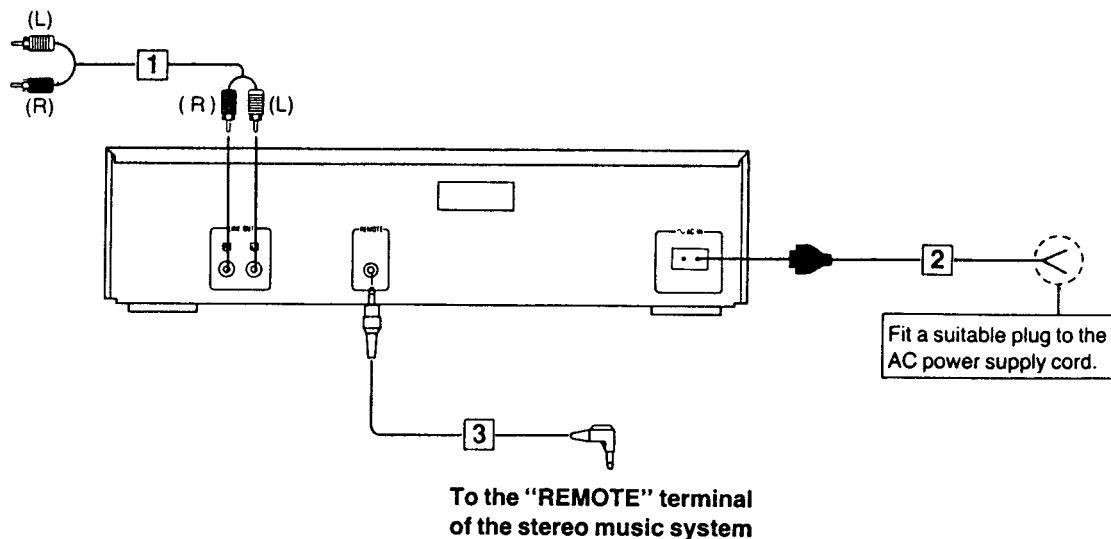
■ CONNECTIONS

Notes:

- Turn power off on all components before making connections.
- See the operating instructions of the stereo music system for details.

To "CD"

terminals of the stereo music system



- 1 Stereo connection cable (included)**

- 3 L-type cable (included)**

This cable can be used only with a Panasonic stereo music system having the appropriate "REMOTE" terminal.

- 2 AC power supply cord (included)**

Note:

The configuration of the AC outlet and AC power supply cord differs according to area.

■ GROUNDING FOR ELECTROSTATIC BREAKDOWN PREVENTION

1 Human body grounding

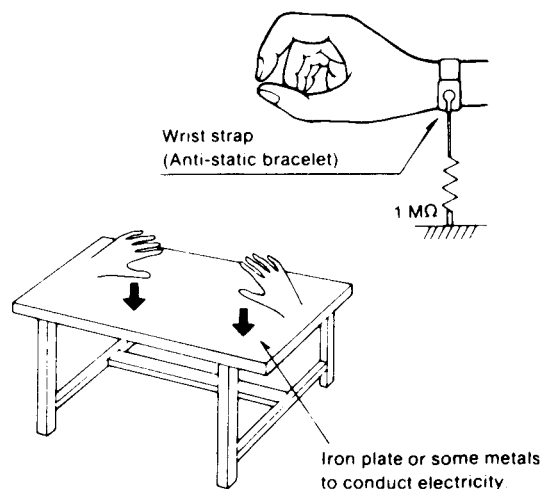
Use the anti-static wrist strap to relieve the static electricity from your body.

2. Work table grounding

Put a conductive material (sheet) or steel sheet on the area where the optical pickup is placed, and ground the sheet.

Caution:

The static electricity of your clothes will not be grounded through the wrist strap. So, take care not to let your clothes touch the optical pickup.



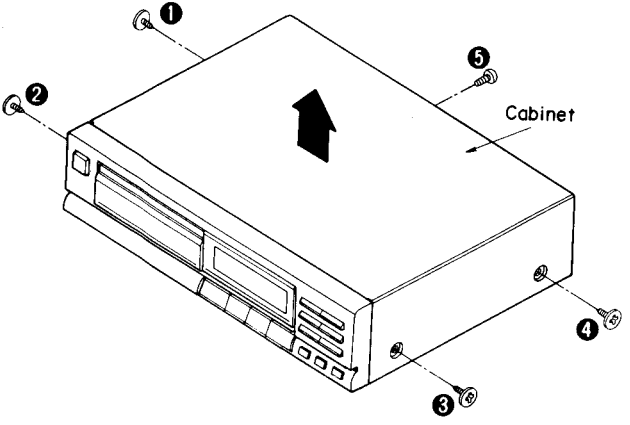
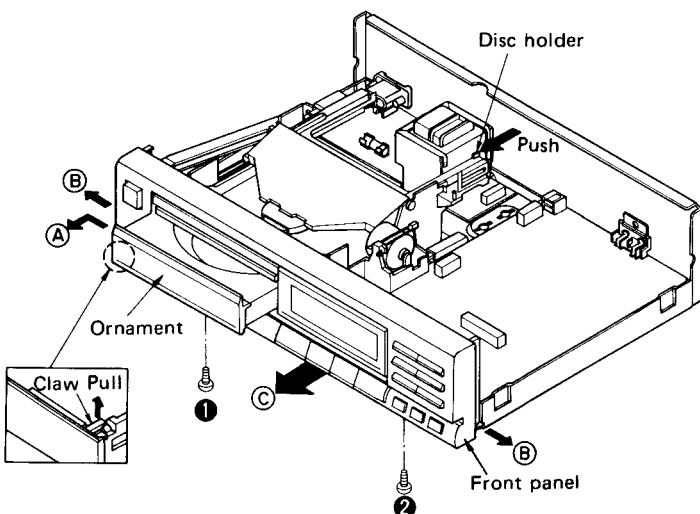
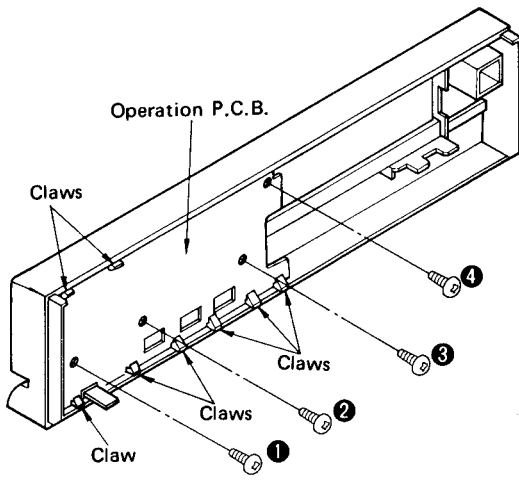
■ DISASSEMBLY INSTRUCTIONS

Warning: This product uses a laser diodes. Refer to caution statements on page 3.

ACHTUNG: •Die lasereinheit nicht zerlegen.

•Die lasereinheit darf nur gegen eine vom hersteller spezifizierte einheit ausgetauscht werden.

* This CD player is equipped with FPC boards, so handle them with care during disassembly and reassembly.

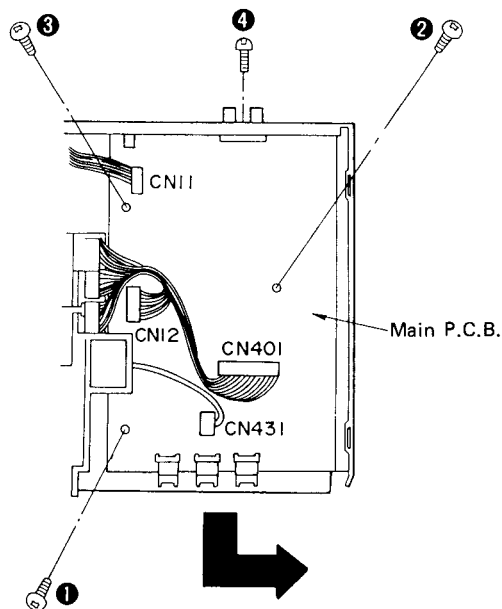
Ref. No. 1	Removal of the cabinet	Ref. No. 2	Removal of the ornament of disc holder and the front panel
Procedure 1	1. Remove the 5 screws (❶ ~ ❺).	Procedure 1→2	A. Ornament of disc holder 1. Push the disc holder slowly in the direction of the arrow. 2. Release the 1 claw and the ornament in the direction of the arrow (❶). B. Front panel 1. Remove the 2 screws (❶, ❷). 2. Slightly pull out the front panel in the direction of the arrow (❷). 3. Remove the front panel in the direction of the arrow (❸).
			
Ref. No. 3	Removal of the operation P.C.B.		
Procedure 1→2→3	1. Remove the 4 screws (❶ ~ ❹). 2. Release the 8 claws.		
			

Ref. No.
4

Removal of the main P.C.B.

Procedure
1→2→3
→4

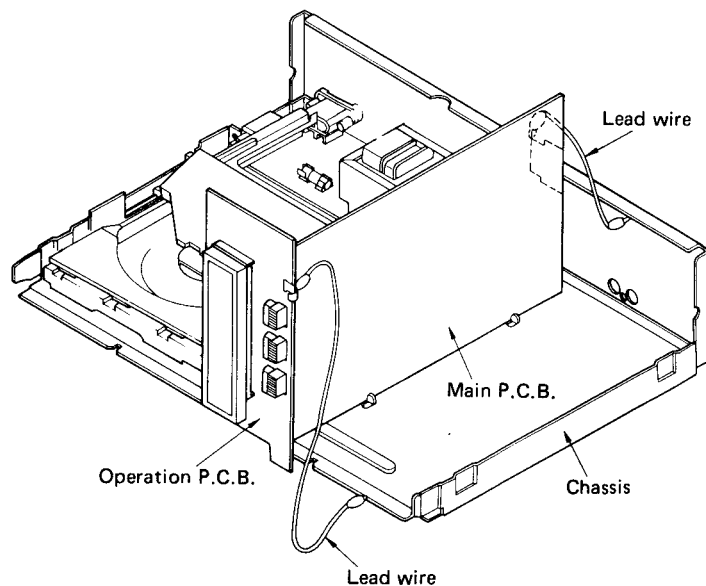
1. Remove the 4 screws (①~④).
2. Remove the 4 connectors (CN11, CN12, CN401, CN431).
3. Lift the main P.C.B. off the retention posts on the chassis.
4. Remove the main P.C.B. in the direction of the arrow.



How to check the main P.C.B.

When checking the soldered surface of the main P.C.B. and replacing the parts, do as shown below.

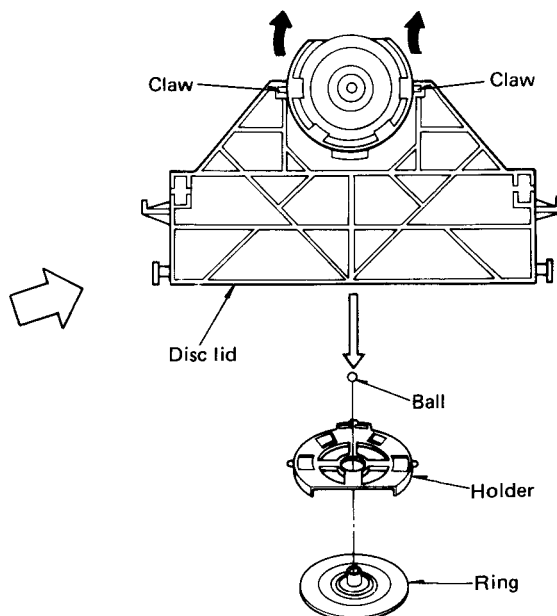
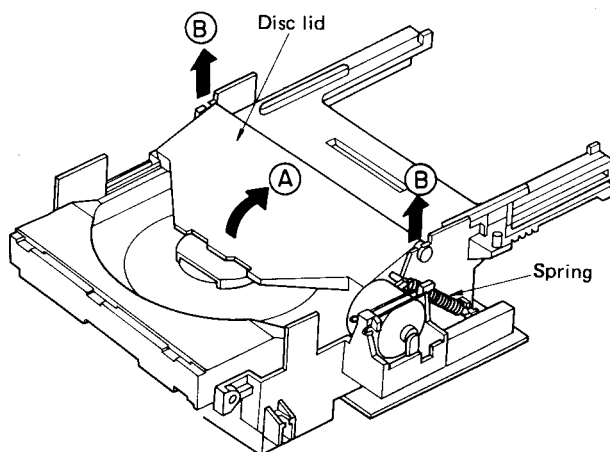
1. Connect the main P.C.B. ground terminal (LINE OUT terminal) to the chassis with a lead wire.
2. Connect the operation P.C.B. ground terminal to the chassis with a lead wire.

Ref. No.
5

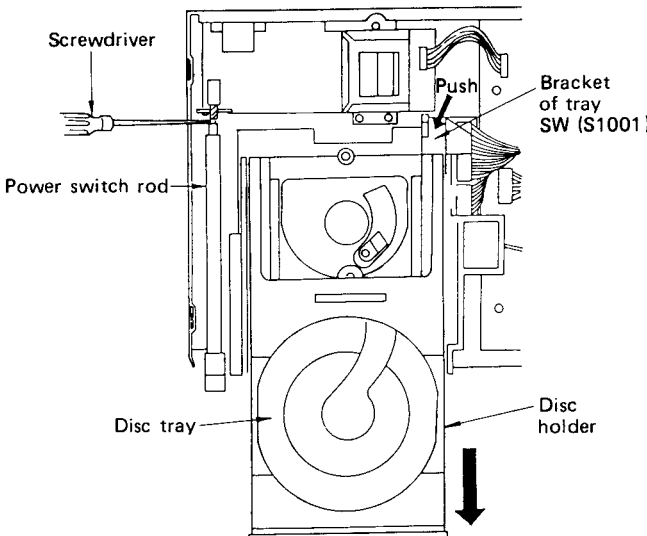
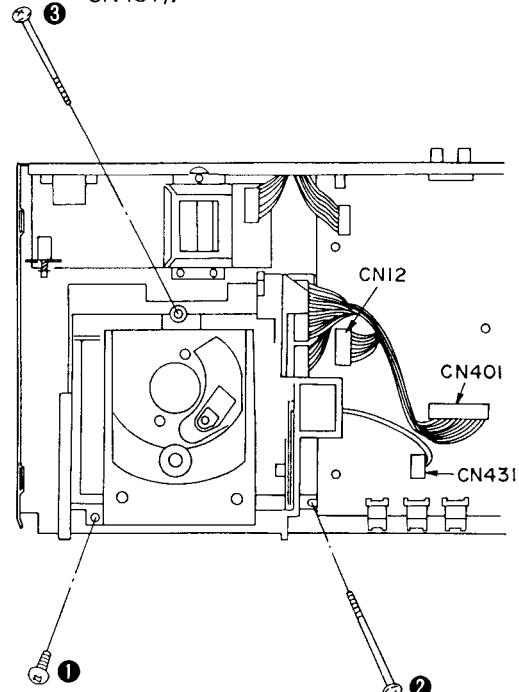
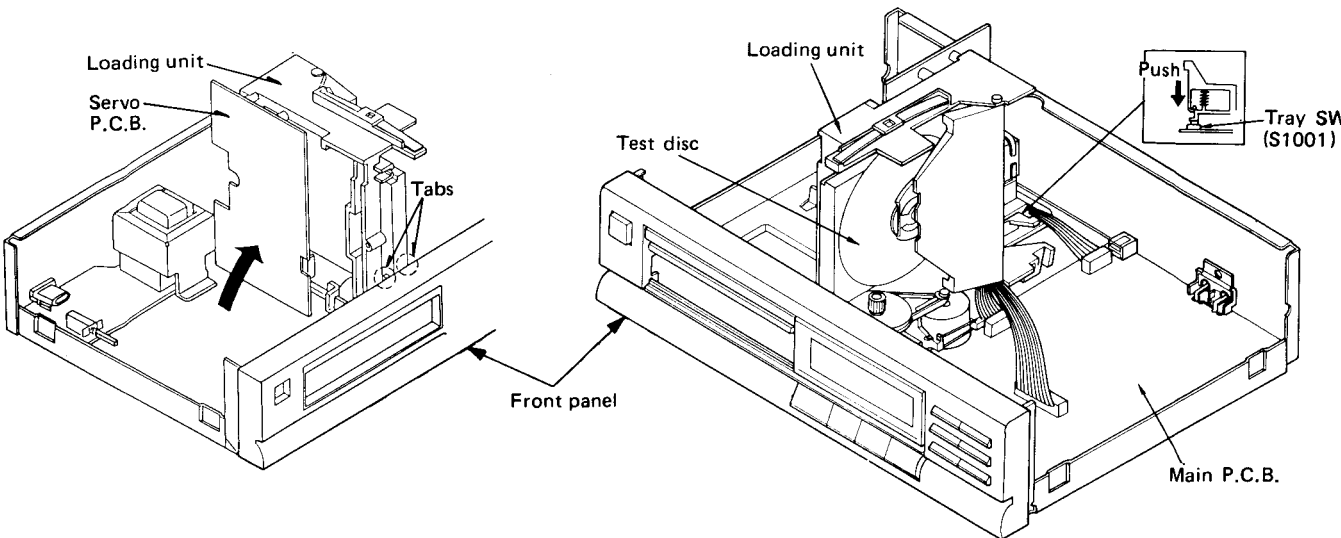
Removal of the disc lid

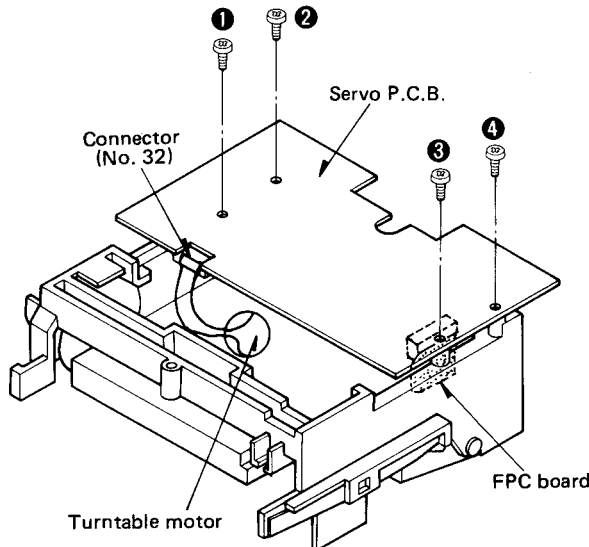
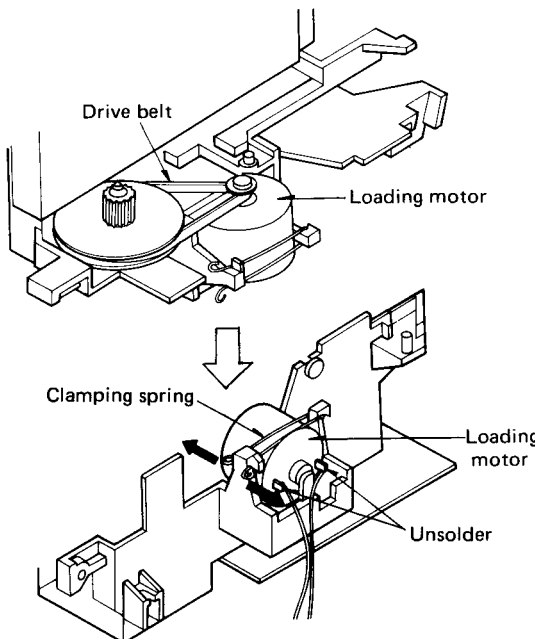
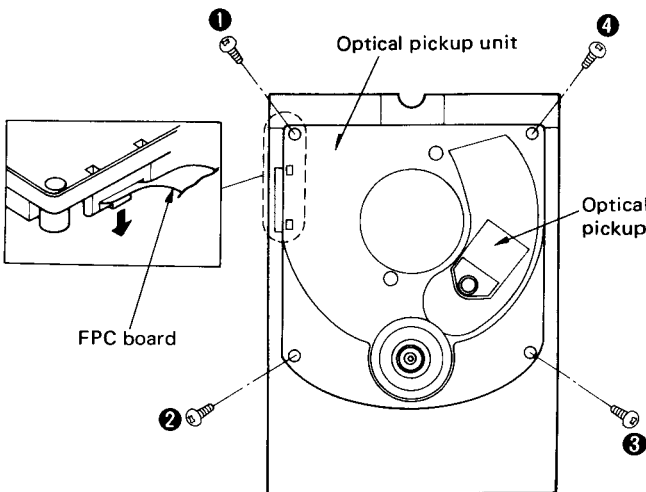
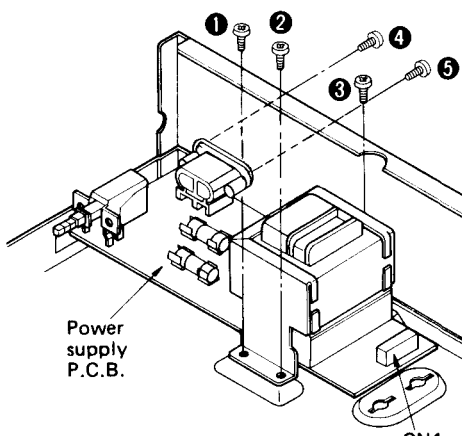
Procedure
1→5

1. Remove the spring.
2. Pull out the disc lid in the direction of the arrow.
3. Push the 2 claws in the direction of the arrow.



Caution: Be sure to handle the small ball carefully.

Ref. No. 6	Removal of the disc holder and power switch rod	Ref. No. 7	Removal of the loading unit
Procedure 1→2→5→6	A. Disc holder 1. Pull the disc holder slowly in the direction of the arrow until the disc tray comes up. 2. Pull the disc holder until it stops. 3. Push the bracket of tray SW (S1001) in the direction of the arrow. 4. Pull out the disc holder further to remove it. B. Power switch rod 1. Set the power switch in the "OFF" position. 2. Remove the power switch rod by using a screwdriver. 	Procedure 1→2→5 →6→7	1. Remove the 3 screws (①~③). 2. Remove the 3 connectors (CN12, CN401, CN431). 
Ref. No. 8	How to check the servo P.C.B.		
Procedure 1→7→8	• When checking the soldered surfaces of the servo P.C.B. and replacing the parts, do as shown below.		
Note: Insert the loading unit into the tabs of the front panel. (Fixed loading unit)			
(To play a disc) 1. Place the test disc. 2. Turn "ON" the power switch of the player. 3. Push the bracket of tray SW (S1001) in the direction of the arrow and release it.			
Note: If the test disc fails to rotate, press the tray switch again.			
			

Ref. No. 9	Removal of the servo P.C.B.		
Procedure 1→2→5 →6→7→9	1. Remove the 4 screws (①~④). 2. Remove the FPC board from the optical pickup. 3. Remove the connector (Ref. No. 32) of the turntable motor. Caution: To prevent the breakdown of the laser diode, antistatic shorting pin is inserted into the FPC board.		
Ref. No. 10	Removal of the loading motor	Ref. No. 11	Removal of the optical pickup unit
Procedure 1→6→10	1. Remove the drive belt. 2. Release the clamping spring. 3. Unsolder the 2 terminals of the lead wire of the loading motor. 		
		Procedure 1→2→5→6 →7→9→11	1. Remove the 4 screws (①~④). 2. Remove the FPC board from the optical pickup. 
Ref. No. 12	Removal of the power supply P.C.B.		
Procedure 1→6→12	1. Remove the 5 screws (①~⑤). 2. Remove the connector (CN1).		

■ MEASUREMENTS AND ADJUSTMENTS

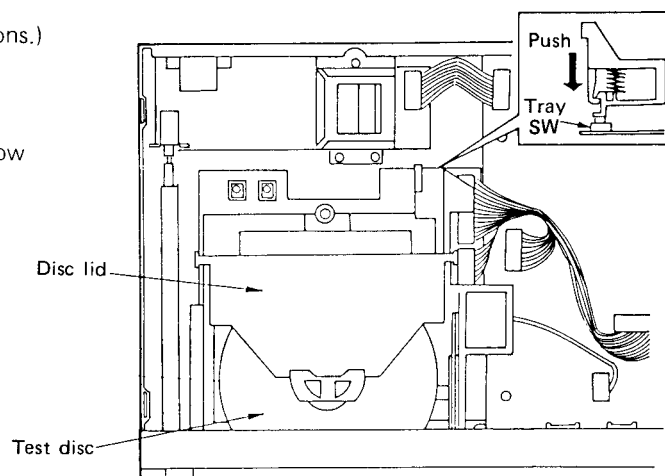
Caution:

It is very dangerous to look at or touch the laser beam. (Laser radiation is invisible.)
 With the unit turned "on", laser radiation is emitted from the pickup lens.
 Avoid exposure to the laser beam, especially when performing adjustments.

PREPARATION

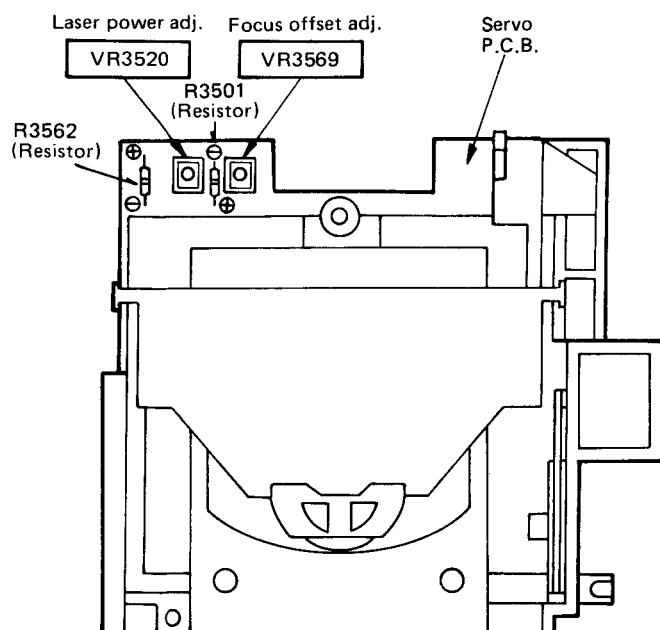
1. Remove the cabinet (see Ref No. 1 of the disassembly instructions.)
2. Remove the disc holder (see Ref No. 6 of the same).
3. Place the test disc on the turntable.
4. Turn "ON" the power switch at the player.
5. Push the bracket of tray SW (S1001) in the direction of the arrow and release it.

Note: If the test disc fails to rotate, press the tray switch again.

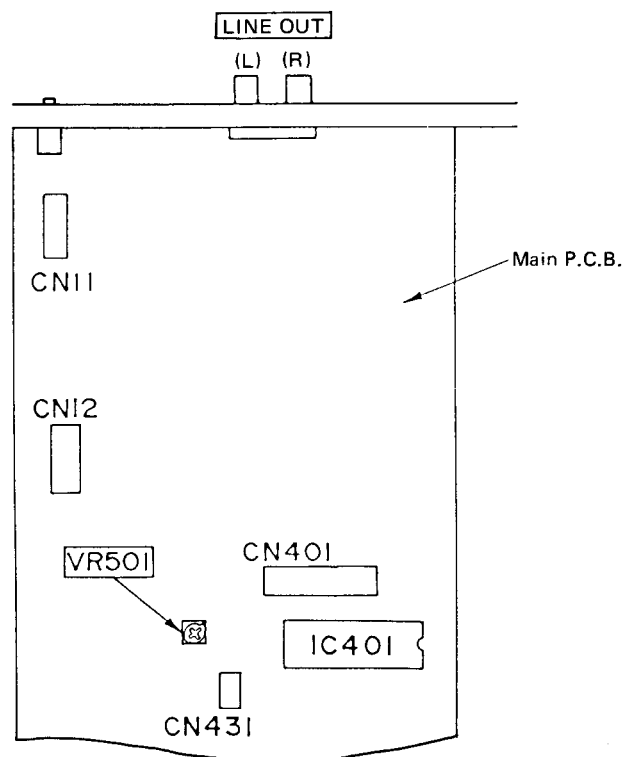


ADJUSTMENT POINTS

• Servo P.C.B.



• Main P.C.B.



Measuring Instruments

- * Playability test disc (SZZP1054C).
- * Normal disc.

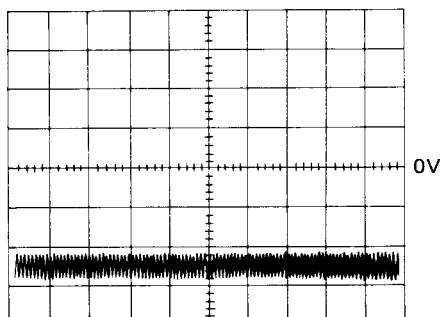
- * Dual-beam oscilloscope with bandwidth of 30MHz or better (with EXT trigger and 1:1 probe).

(1) LASER POWER ADJUSTMENT

1. Connect the oscilloscope's CH1 probe across (+) and (–) of **R3501** (Resistor) on the servo P.C.B.
2. Switch the player power ON, and play track No. 1 on the test disc (SZZP1054C).
3. Adjust **VR3520** so that the voltage is $-50 \pm 2\text{mV}$.

Oscilloscope setting:

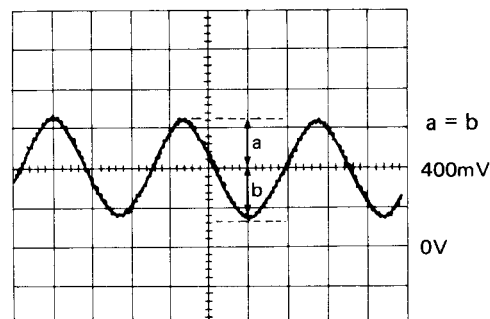
[VOLT 20mV INPUT DC]
 [SWEEP 0.2msec.]

**(2) FOCUS OFFSET ADJUSTMENT**

1. Connect the oscilloscope's CH1 probe across (+) and (–) of **R3562** (Resistor) on the servo P.C.B.
2. Switch the player power ON, and play track No.1 on the test disc (SZZP1054C).
3. Adjust **VR3569** until the signal amplitude become in the center of **400mV**.

Oscilloscope setting:

[VOLT 200 mV INPUT DC]
 [SWEEP 50msec.]

**(3) PLL ADJUSTMENT**

1. Connect CH1 of the oscilloscope to the **LINE OUT** terminal (either of Lch or Rch) and **ground**.

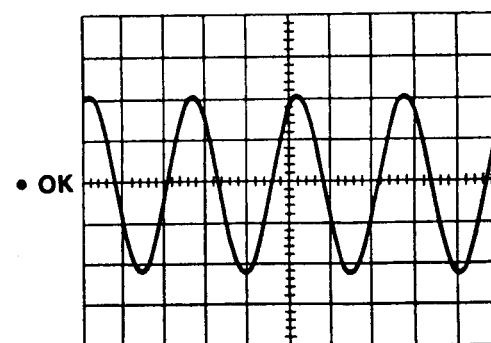
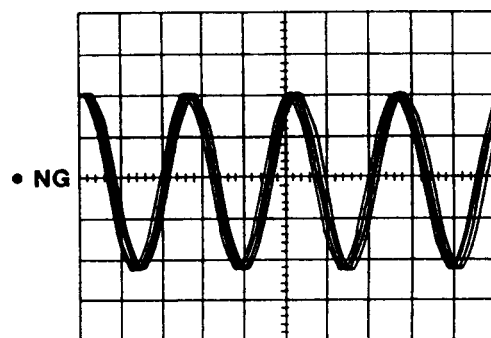
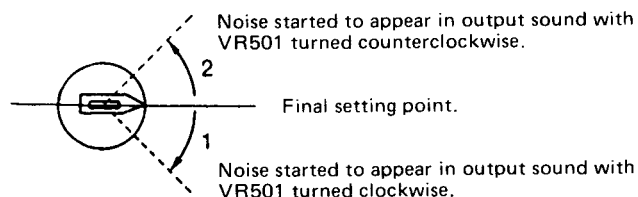
Oscilloscope setting: VOLT 1V
 SWEEP 1msec.
 INPUT DC

2. Switch the player power ON, and play track No. 6 (wedge 0.7mm) on the test disc (SZZP1054C).
3. Check the waveform displayed on the oscilloscope and adjust **VR501** in the following steps.

Step 1. Turn **VR501** clockwise slowly and observe the point at which the waveform on the oscilloscope begins to be disturbed.

Step 2. Turn **VR501** counterclockwise slowly and observe the point at which the waveform on the oscilloscope begins to be disturbed.

Step 3. Set **VR501** in the middle between the points observed in the above steps "1" and "2".

**(4) CHECK OF PLAY OPERATION AFTER ADJUSTMENT***** Checking Skip Search**

1. Play an ordinary musical program disc.
2. Press the skip button to check for normal skip search operation (in both the forward and reverse directions).

*** Checking Manual Search**

1. Play an ordinary musical program disc.
2. Press the manual search button to check for smooth manual search operations at either low or high speed (in both the forward and reverse directions).

*** Playability check by test disc**

1. Play the 0.7 mm black dot and the 0.7 mm wedge on the defect test disc (SZZP1054C) and verify that no sound skip or noise occurs.

■ TERMINAL FUNCTIONS OF IC's

● IC6501 (TDA8808T): Photo diode signal processor

Pin No.	Mark	I/O Division	Function
1	GCHF	I	Gain control input of HF amplifier. Current output from HF amplitude detector
2	Vp	I	Positive supply voltage
3	HFout	O	HF amplifier and equalizer voltage output
4	DET	I	HF detector voltage input
5	Sc	I	Starting up capacitor input
6	Si/RD	I/O	On/off control (start input); ready signal output (starting up procedure successful)
7	Beq	I	Equalizer reference current input
8	Bgc	I	DC and LF gain control reference current input
9	FOC START	I	Focus normalizing circuit starting current
10	PLLH	O	PLL on hold output
11	TL	O	Track loss output
12	DODS	I	Drop out detector suppression input
13	Vext	I	Negative supply connection for FE and FElag output stage; also substrate connection
14	LPF	O	Low pass filter for Iret, used in track loss (TL) detector and LF gain control

Pin No.	Mark	I/O Division	Function
15	FE	O	Current output of normalized, switched focus error signal
16	FElag	O	Current output of switched focus error signal, intended for lag network
17	LO	O	Laser amplifier current output
18	LM	I	Laser monitor diode input
19	GCLF	I	Gain control input for AC and LF amplifiers. Current output from LF amplitude detector
20	Re2	O	Summation of amplified currents from D3 and D4
21	Re1	O	Summation of amplified currents from D1 and D2
22, 23	D1, D2	I	Current inputs to DC and LF photo diode amplifier
24, 25	D3, D4	I	Current input to DC and LF photo diode amplifier
26	HFin	I	Current input to HF amplifier
27	GND	I	Ground connection of device
28	DEC	I	Decoupling input (internal bypass)

● IC6503 (TDA8809T): Radial error signal processor

Pin No.	Mark	I/O Division	Function
1	Vp	I	Positive supply voltage
2	Cosc1	I	Frequency setting capacitors for oscillator
3	Cosc2		
4	Rwob	I	Wobble generator input
5	Rosc	I	Biassing resistor for oscillator frequency and internal amplitude
6	DIV4	I	Divide-by-4 input
7	REdig	O	Digital output of sign (Re2 – Re1)
8	B3	I	Input control bits for off-, catch-, plat- status and DAC output current
9	B2		
10	B1		
11	B0		
12	Vext(+)	I	Positive external voltage input
13	Vext(–)	I	Negative external voltage input (also substrate connection)
14	GND	I	GND terminal
15	RADout	O	Current output of amplified (Re2 – Re1) input currents
16	REin	I	Radial error input
17	RElag	O	Voltage output of integrated (Re2 – Re1) input currents

Pin No.	Mark	I/O Division	Function
18	Lag	I	Connection of integrator capacitor for (Re1 – Re2) input currents
19	Lead	O	Lead output
20	Vref	I	Internal reference voltage output
21	AGC	I	Gain control input for radial error signal
22	RDAC	O	Biassing resistor for current output for track jumping (3½ bits)
23	offset in	I	Offset control input for radial offset
24	offset off	O	Offset control output for radial offset
25	CLPF	I	Low-pass filter for Re1 and Re2, used for radial offset control
26	CHPF	I	High-pass filter for Re1 and Re2, used for radial offset control
27	Re1	I	Input for amplified currents from photo-diodes D1 and D2
28	Re2	I	Input for amplified currents from photo diodes D3 and D4

● IC301 (MN6625): Digital signal processing

Pin No.	Mark	I/O Division	Function	Pin No.	Mark	I/O Division	Function
1	BYTCK	O	Serial data byte clock (Not used, open)	25	MCLK	I	Data clock for MDATA
2	FCLK	O	Crystal frame clock (Not used, open)	26	MDATA	I	Mode control data
3	DEMPH	O	De-emphasis ON signal (de-emphasis ON at "H") (Not used, open)	27	DMUTE	I	Data mute command
4	SRDATA	O	Serial data output (MSB first)	28	$\overline{\text{TRON}}$	I	Tracking servo ON signal (tracking servo ON at "L")
5	SCK	O	Serial bit clock output	29	STAT	O	Status command for CRC etc. . .
6	LRCK	O	LR discrimination clock (88.2kHz)	30	SUBC	O	Sub-code serial output data (Not used, open)
7	WDCK	O	Serial data output word clock (Not used, open)	31	SBCK	I	Clock for sub-code serial output (Not used, open)
8	LDG	O	L channel deglitch signal (Not used, open)	32	SMCK	O	System clock (4.2336MHz)
9	RDG	O	R channel deglitch signal (Not used, open)	33	VDD	I	Power supply (connected to +4.9V)
10	IPFLAG	O	Interpolation flag (interpolation at "H") (Not used, open)	34	MEMP	I	Deemphasis command
11	FLAG	O	Error flag terminal (Not used, open)	35	FG	I	Turntable motor FG signal input (Not used, open)
12	XCK	O	Clock (16.9344 MHz) output (Not used, open)	36	PC	O	Turntable motor ON command (ON at "L")
13	TEST	I	Test mode selection (Not used, connected to +4.9V)	37	EC	O	Turntable motor drive signal
14	TX	O	Digital signal output (Not used, open)	38	RESY	O	Resynchronizing signal (Not used, open)
15	SLEEP	I	Mode selector ("L": normal, "H": SLEEP mode) (Not used, connected to GND)	39	DO	I	Drop-out detection signal (Drop-out at "H")
16	CSEL	I	Test terminal ("L": normal) (Not used, connected to GND)	40	SRF	I	Sliced RF signal
17	X1	I	Clock input (16.9344 MHz)	41	EFM	I	Modulation data
18	X2	O	Clock output (16.9344 MHz) (Not used, open)	42	PCK	I	PLL extract clock (4.2336MHz)
19	VSS	I	GND terminal	43	FPC	O	PLL frequency comparison signal
20	BLKCK	O	Sub-code Q data block clock (75 Hz)	44 } 51	D7 } D0	I/O	16K RAM data input/output
21	$\overline{\text{CLDCK}}$	O	Sub-code frame clock (7.35kHz)	52	RAM OE	O	Read out enable
22	$\overline{\text{SUBQ}}$	O	Sub-code Q data	53	RAM WE	O	Write enable
23	$\overline{\text{RST}}$	I	Reset command	54 } 64	RAM A0 } RAM A10	O	16K RAM address signal (RAMA0: LSB, RAMA10: MSB)
24	MLD	I	Load command for mode control data				

● IC401 (MN1554PJE-2): System control

Pin No.	Mark	I/O Division	Function
1	VSS	I	GND terminal
2	DMUTE	O	Data mute command
3	MDATA	O	Mode control data
4	MCLK	O	Data clock for MDATA
5	MLD	O	Load command for mode control data
6	NC	—	Not connected
7	NC	—	Not connected
8	INH	O	Track loss det. signal output
9	MUTE	O	Muting signal output
10	EMPH	O	Deemphasis command
11	NC	—	Not connected
12	SIRQ	I	Track loss det. signal input
13	BLKCK	I	Sub-code Q data block clock (75 Hz)
14	CLDCK	I	Sub-code Q data frame clock (7.35 KHz)
15	NC	—	Not connected
16	SUBQ	I	Sub-code Q data
17	RESET	I	Reset command
18	TL	I	Track loss signal
19	RE DIG	I	Radial error digital
20	HFD	I	HF detector output for PLLH
21	TRAY SW	I	Disc holder open/close det. signal input
22	DIV4	O	Radial error digital divided by four
23	DODS	O	Drop out detector suppression
24	MODEA	—	Not used, open
25	FR/REV	—	Not used, open
26	B0	O	Control bits for radial circuit
27	B1		
28	B2		
29	B3		
30	CLOSE	O	Disc tray "close" detection
31	OPEN	O	Disc tray "open" detection

Pin No.	Mark	I/O Division	Function
32	TR ON	O	Tracking servo ON command
33	VDD	I	Power supply (connected to +4.9V)
34	NC	—	Not connected
35	NC	—	Not connected
36	P53	—	Not used, open
37	P60	I	Period det. select signal input
38	POL	I	Period det. select signal input
39	SKATE	I	Period det. select signal input
40	STAT	I	Status command for CRC etc. . . .
41	SP0	I	Speed control code input
42	SP1		
43	SP2		
44	SP3		
45	RECV	I	Data receipt command signal
46	SEND	I	Data transmission command signal
47	ACK	I	Data discrimination signal
48	CLK	I	Data clock signal
49	DATA0	I	Key scan signal
50	DATA1		
51	DATA2		
52	DATA3		
53	CMD0	O	Command signal of access mode
54	CMD1		
55	CMD2		
56	CMD3		
57	NC	—	Not connected
58	NC	—	Not connected
59	NC	—	Not connected
60	SI/RD	I/O	On/off control for laser supply and focus circuit
61	OSC2	I	Clock input
62	OSC1	I	Clock input (4.2336 MHz)
63	XI	I	Digital input of signal
64	X0	—	Not used, open

● IC403 (MN1551 PJF-1): Period det. & speed control

Pin No.	Mark	I/O Division	Function
1	VDD	I	Power supply (connected to +4.9V)
2	NC	—	Not connected
3	NC	—	Not connected
4	TL	I	Track loss signal
5	REDIG	I	Radial error digital
6	DIV4	I	Radial error digital divided by four
7	SP3	O	Speed control code output
8	SP2		
9	SP1		
10	SP0		
11	SKATE	O	Period det. select signal output
12	POLAR	O	Period det. select signal output
13	DIVC	O	Period det. select signal output
14	SIRQ	O	Track loss det. signal output

Pin No.	Mark	I/O Division	Function
15	COMO0	I	Command signal of access mode
16	COMO1		
17	COMO2		
18	COMO3		
19	NC	—	Not connected
20	NC	—	Not connected
21	NC	—	Not connected
22	NC	—	Not connected
23	NC	—	Not connected
24	SYNC	—	Not used, open
25	RESET	I	Reset command
26	OSC2	—	Not used, open
27	OSC1	I	192 fs (8.4672 MHz) clock input
28	VSS	I	GND terminal

● IC601 (MN15283PJH): System control and FL drive

Pin No.	Mark	I/O Division	Function
1	VSS	I	GND terminal
2	X0	O	Not used, open
3	X1	I	Optical servo condition input (Not used, open)
4	PO0(RECV)	O	Data receipt command signal
5	PO1(SEND)	O	Data transmission command signal
6	PO2 (ACK)	O	Data discrimination signal
7	PO3 (CLK)	O	Data lock signal
8 } 11	P10 (D0) } P13 (D3)	O	Key scan signal
12	SYNC	O	Not used, open
13	RST	I	Reset command (reset at "L")
14	IRQ/TC1	I	Remote control signal input
15 } 18	P50 } P53	I	Key return signal
19	SBT	I	Sub-code frame clock (7.35 kHz) (Not used, open)
20	SBD	I	Sub-code Q data input (Not used, open)
21 } 24	P20 } P23	O	Key scan signal
25	P30	O	Key scan signal
26	P31		

Pin No.	Mark	I/O Division	Function
27	P32	—	Not used, open
28	P33	O	Not used, open
29	P40	I	Key return signal
30	P41	—	Not used, open
31	42	—	Not used, open
32	43	—	Not used, open
33	P60	—	Not used, open
34	P61	—	Not used, open
35	DAC	—	Not used, open
36	VPP	I	FL drive power supply (connected to -27.8V)
37 } 52	D0 } D9 • DA } DF	O	FL grid signal
53 } 61	S8 } S0	O	FL anode signal
62	VDD	I	Power supply (connected to +4.9V)
63	OSC2	I	Clock terminal
64	OSC1	I	Clock input

• IC501 (AN8371S): Data slice and PLL

Pin No.	Mark	I/O Division	Function
1	VEE	I	Power supply (connected to -5.2V)
2	SRF	O	Sliced RF signal
3	EFM	O	Modulation data
4	D.GND	I	GND terminal (digital system)
5	PCK	O	PLL extract clock (4.2336MHz)
6	VCC	I	Power supply (connected to +4.9V)
7	VA	I	VCO free run frequency adjusting current input (Not used, open)
8, 9	VC1, 2	I	Capacitor connection for VCO oscillator frequency
10	VR	I	Resistor connection for VCO oscillator frequency
11	PD	I	Capacitor connection for PLL DO protection
12	PL1	I	PLL loop filter connection

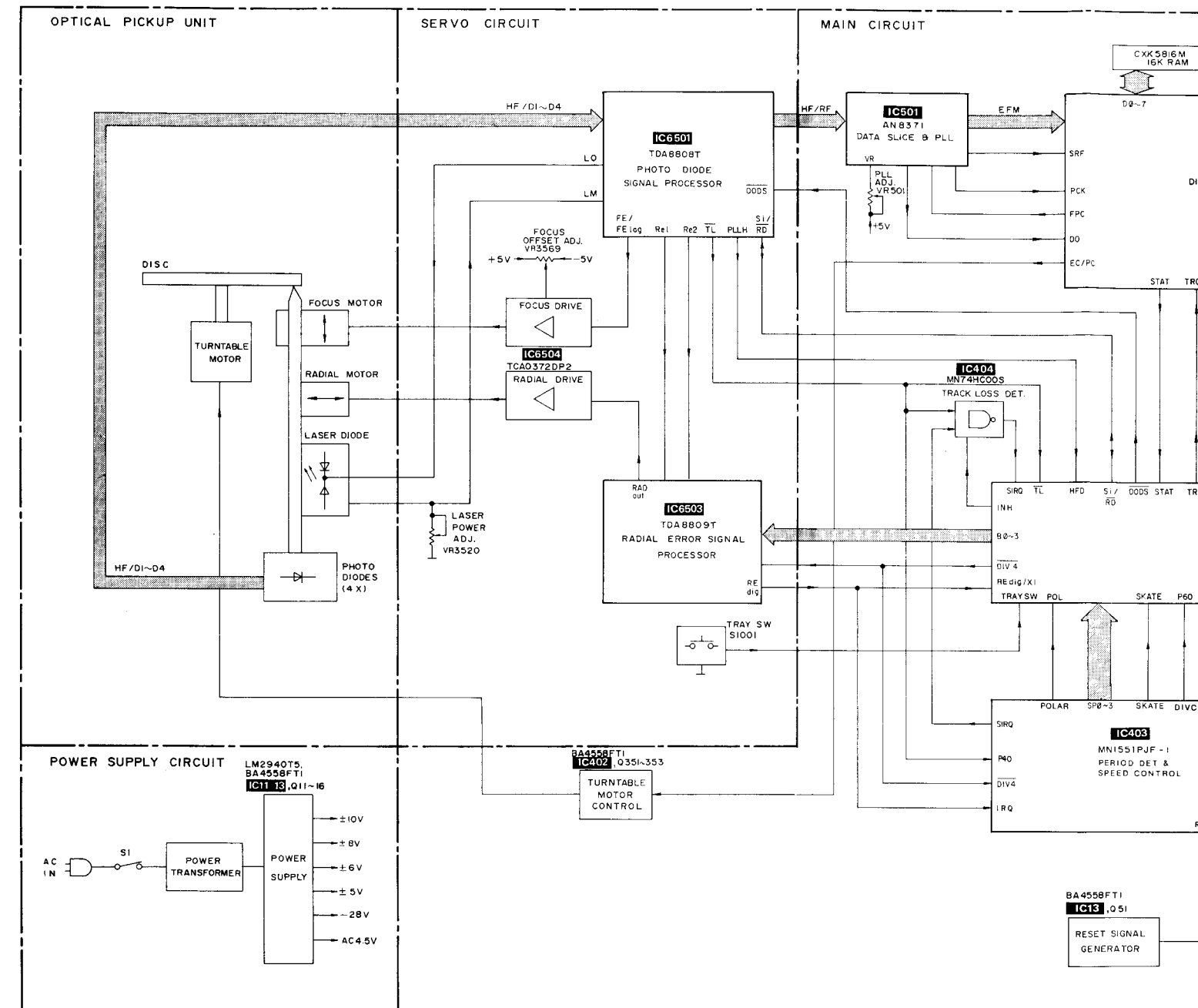
Pin No.	Mark	I/O Division	Function
13	PL2	I	PLL loop filter connection
14	FPC	I	PLL frequency comparison signal
15	RF	I	Data
16	ARF	O	RF signal output with AGC output
17	AGC	I	ARF signal input for AGF drop-out detection input
18	AC	I	Loop filter for AGC connected
19	DO	O	Drop-out detection signal
20	A.GND	I	GND terminal (analog system)
21	DSL	I	RF signal input for data slicing
22	SLC	I	Slicing level control signal input (Not used, connected to GND)
23	FC1	I	Filter capacitor for data slicer connected
24	FC2	I	Filter capacitor for data slicer connected

• IC801 (MN6471): Digital filter and D/A converter

Pin No.	Mark	I/O Division	Function
1	MLD	I	Command load input (load: L)
2	RSTB	I	Reset command
3	IE	I	Not used, connected to GND
4	TP1	—	TEST terminal
5	TP2	—	
6	TEST1	I	TEST terminal 1 (connected to GND)
7	TEST2	I	TEST terminal 2 (connected to GND)
8	NC	—	Not connected
9	NC	—	Not connected
10	AVDD4	I	Power supply (connected to +4.7V)
11	OUTL (-)	O	Lch data output, (-) terminal
12	AVSS4	I	GND terminal
13	AVSS3	I	GND terminal
14	OUTL (+)	O	Lch data output, (+) terminal
15	AVDD3	I	Power supply (connected to +4.7V)
16	NC	—	Not connected
17	AVDD2	I	Power supply (connected to +4.7V)
18	OUTR (+)	O	Rch data output, (+) terminal
19	AVSS2	I	GND terminal (analog system)
20	AVSS1	I	GND terminal (analog system)
21	OUTR (-)	O	Rch data output, (-) terminal

Pin No.	Mark	I/O Division	Function
22	AVDD1	I	Power supply (connected to +4.7V)
23	DVDD1	I	Power supply (connected to +4.5V)
24	DVSS1	I	GND terminal (digital system)
25	X2	O	Clock output
26	X1	I	Clock input
27	NC	—	Connected to GND
28	DVDD2	I	Power supply (connected to +4.5V)
29	DVSS2	I	GND terminal (digital system)
30	NSUB	I	Sub-strate terminal (Not used, connected to +4.5V)
31	ZFLGB	O	Zero input detector terminal (Not used, open)
32	192fs	O	192 fs (8.4672MHz)
33	LRPOL	I	LR clock selector (Not used, connected to +4.5V)
34	LRCLK	I	LR discrimination signal input
35	BCLK	I	Serial bit clock input
36	SRDATA	I	Serial data input (MSB first)
37	DVSS 3	I	GND terminal (digital system)
38	DVDD	I	Power supply (connected to +4.5V)
39	384 fs	O	384 fs (16.9344MHz) output
40	PD	I	Power down terminal (Not used, connected to GND)
41	MDATA	I	Mode control data
42	MCLK	I	Data clock for MDATA

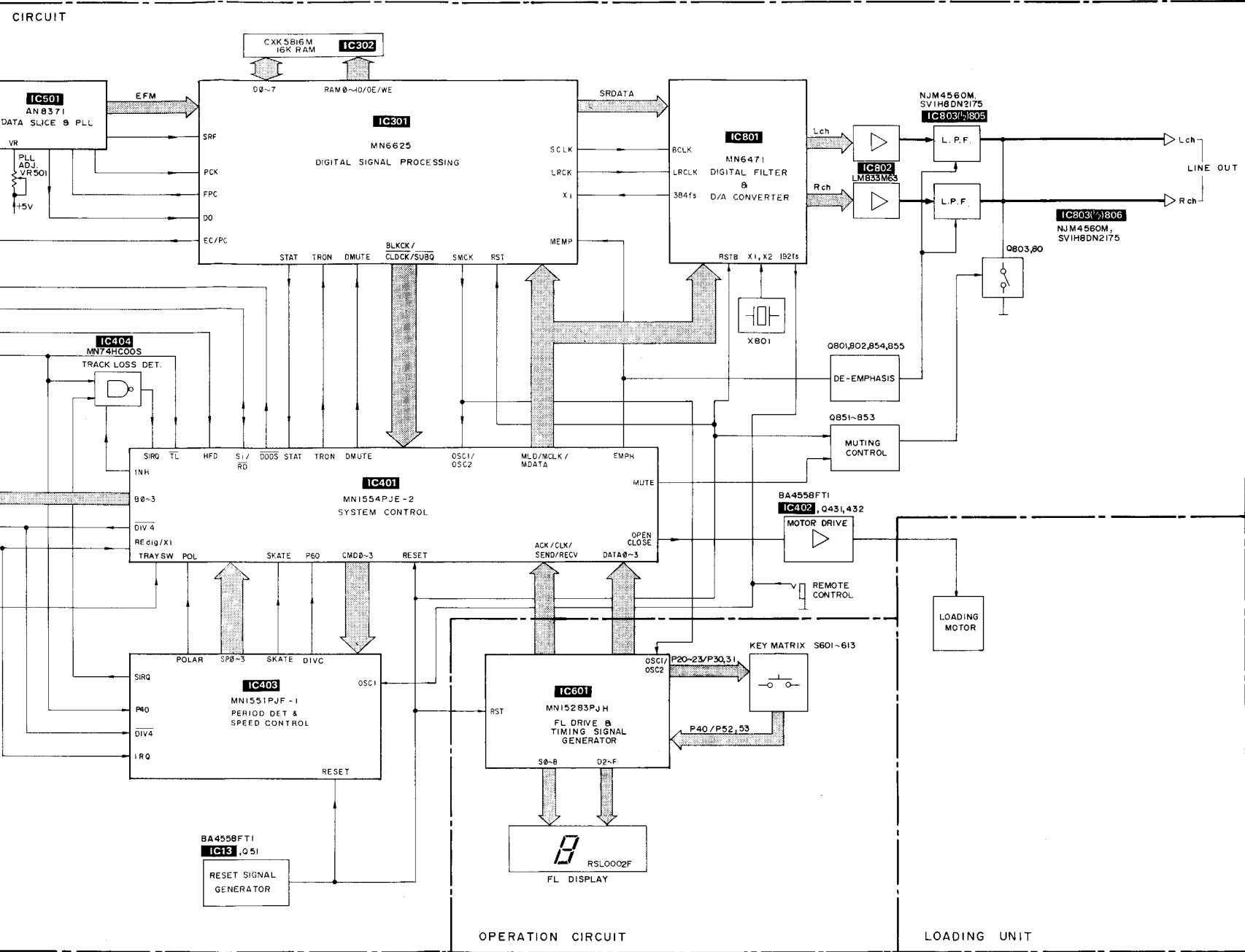
■ BLOCK DIAGRAM



B0-B3 : Control bits for radial circuit.
 DAC : Current output for track jumping. (Digital to Analogue Converted)
 D0DS : Drop out detector suppression.
 D1-D4 : Photodiode currents.
 FE : Focus error signal.
 FE lag : Focus error signal for LAG network.
 HF : HF output for DEMOD.
 HFD : HF detector output for DEMOD.
 HF-in : HF current input.
 LM : Laser monitor diode input.
 LO : Laser amplifier current output.
 RE : Radial error signal (amplified RE2 - RE1 currents).
 RE1 : Radial error signal 1 (summation of amplified currents D3 and D4).
 RE2 : Radial error signal 2 (summation of amplified currents D1 and D2).

RE dig : Radial error digital.
 RE lag : Radial error signal for LAG network
 RPU : Radial puls after track jumping.
 Si/RD : On/off control for laser supply and focus circuit.
 TL : Track loss signal.
 Div4 : Radial error digital divided by four.
 RF : Data
 DO : Drop-out detection signal (Active High)
 SRF : Sliced RF signal.
 EFM : Modulation data.
 PCK : PLL extract clock (4.2336MHz)
 FPC : PLL frequency comparison signal
 STAT : Status command for CRC etc.
 DMUTE : Data mute command
 MDATA : Mode control data
 MLD : Load command for mode control data (Active Low)

MCLK
 SUBQ
 CLDCK
 BLKCK
 RST
 TRON
 EC
 PC
 SMCK
 OE
 WE
 LRCK
 SRDATA
 SCK
 MEMP

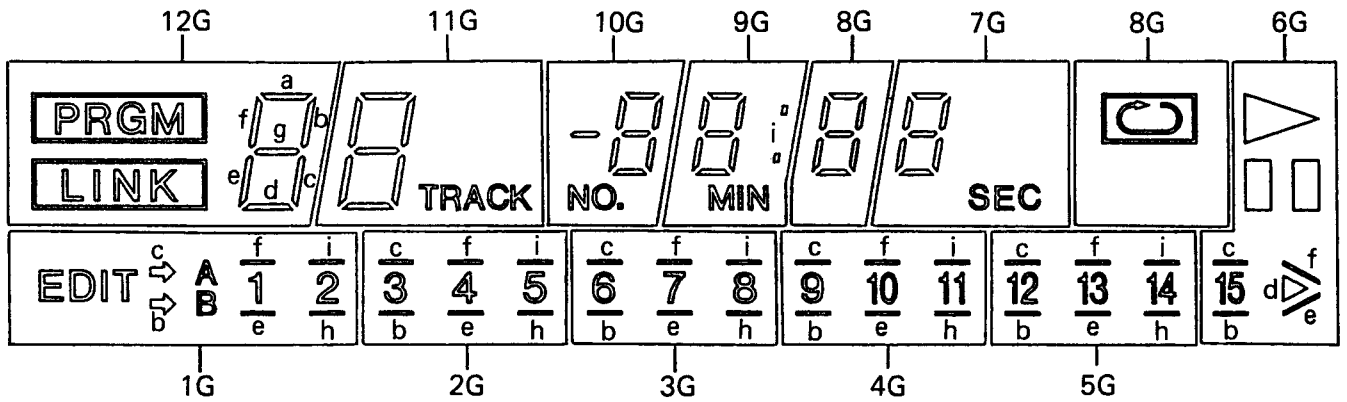


- for LAG network
ack jumping.
user supply and
divided by four.
signal (Active High)
2336MHz)
ison signal
RC etc.
e control data
- MCLK : Data clock for MDATA
 - SUBQ : Sub-code Q data
 - CLDCK : Data frame clock (7.35KHz)
 - BLKCK : Sub-code Q data block clock (75 Hz)
 - RST : Reset command (Active Low)
 - TRON : Tracking servo ON command (Active Low)
 - EC : Spindle motor drive signal
 - PC : Spindle motor ON command (Active Low)
 - SMCK : System clock (4.2336MHz)
 - OE : Read out enable
 - WE : Write enable
 - LRCK : L/R data discrimination clock (88.2KHz)
 - SRDATA : Serial data output (MSB first)
 - SCK : Serial bit clock (2.82MHz)
 - MEMPH : Deemphasis command (Active High)

Note)
• ———> Audio signal.

INTERNAL CONNECTION OF FL

Grid connection diagram



Pin connection table

PIN NO.	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
CONNECTION	F 2	F 2	N P	a	N P	N P	b	c	d	e	f	g	h	i	12 G	11 G	N P	N P	N P	N P	10 G	9 G	8 G	7 G	6 G	5 G	4 G	3 G	2 G	N P	N P	N P	1 G	N P	F 1	F 1

Anode connection table

	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
a	a	a	a	a	a	a	15	12	9	6	3	EDIT A B
b	b	b	b	b	b	b	(15)	(12)	(9)	(6)	(3)	(Down) →
c	c	c	c	c	c	c	(15)	(12)	(9)	(6)	(3)	(Up) →
d	d	d	d	d	d	d	▶	13	10	7	4	1
e	e	e	e	e	e	e	/	(13)	(10)	(7)	(4)	(1)
f	f	f	f	f	f	f	/	(13)	(10)	(7)	(4)	(1)
g	g	g	g	g	g	g	▶	14	11	8	5	2
h	PRGM	TRACK	—	MIN	-	SEC	▬▬	(14)	(11)	(8)	(5)	(2)
i	LINK	-	No.	•	↻	-	-	(14)	(11)	(8)	(5)	(2)

SCHEMATIC DIAGRAM

(Parts list on pages 41 ~ 46.)

(This schematic diagram may be modified at any time with development of new technology.)

Notes:

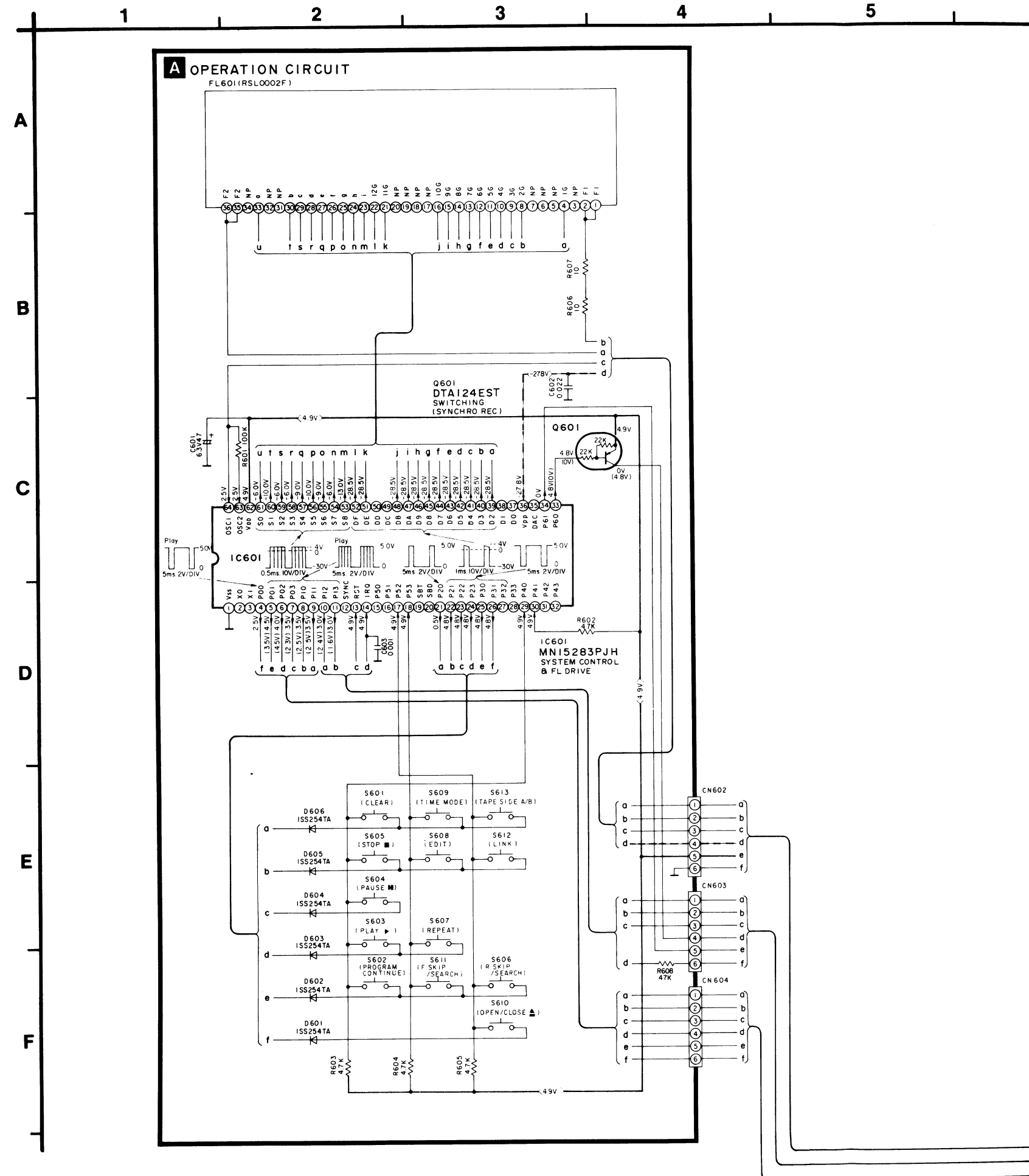
- **S1** : Power switch in "on" position.
- **S601** : Clear (CLEAR) switch.
- **S602** : Program (PROGRAM) switch.
- **S603** : Play (▶ PLAY) switch.
- **S604** : Pause (⏸ PAUSE) switch.
- **S605** : Stop (■ STOP) switch.
- **S606, 611** : Skip/search (SKIP/SEARCH) switches.
- **S607** : Repeat (REPEAT) switch.
- **S608** : Edit tape length (EDIT/TAPE LENGTH) switch.
- **S609** : Time mode select (TIME MODE) switch.
- **S610** : Disc holder open /close (▲ OPEN/CLOSE) switch.
- **S612** : Link (LINK) switch.
- **S613** : Tape-side select (TAPE SIDE A/B) switch.
- **S1001** : Tray (open/close) switch.
- The voltage value and waveforms are the reference voltage of this unit measured by DC electronic voltmeter (high impedance) and oscilloscope on the basis of chassis. Accordingly, there may arise some error in voltage values and waveforms depending upon the internal impedance of the tester or the measuring unit.
- *The parenthesized are the values of voltage generated during playing (Test disc 1kHz, L+R, 0dB), others are voltage values in stop mode.
- Important safety notice:
Components identified by Δ mark have special characteristics important for safety. When replacing any of these components, use only manufacturer's specified parts.
- --- --- --- --- : Positive voltage lines and negative voltage lines.
- --- --- --- --- : Audio signal lines.

Caution!

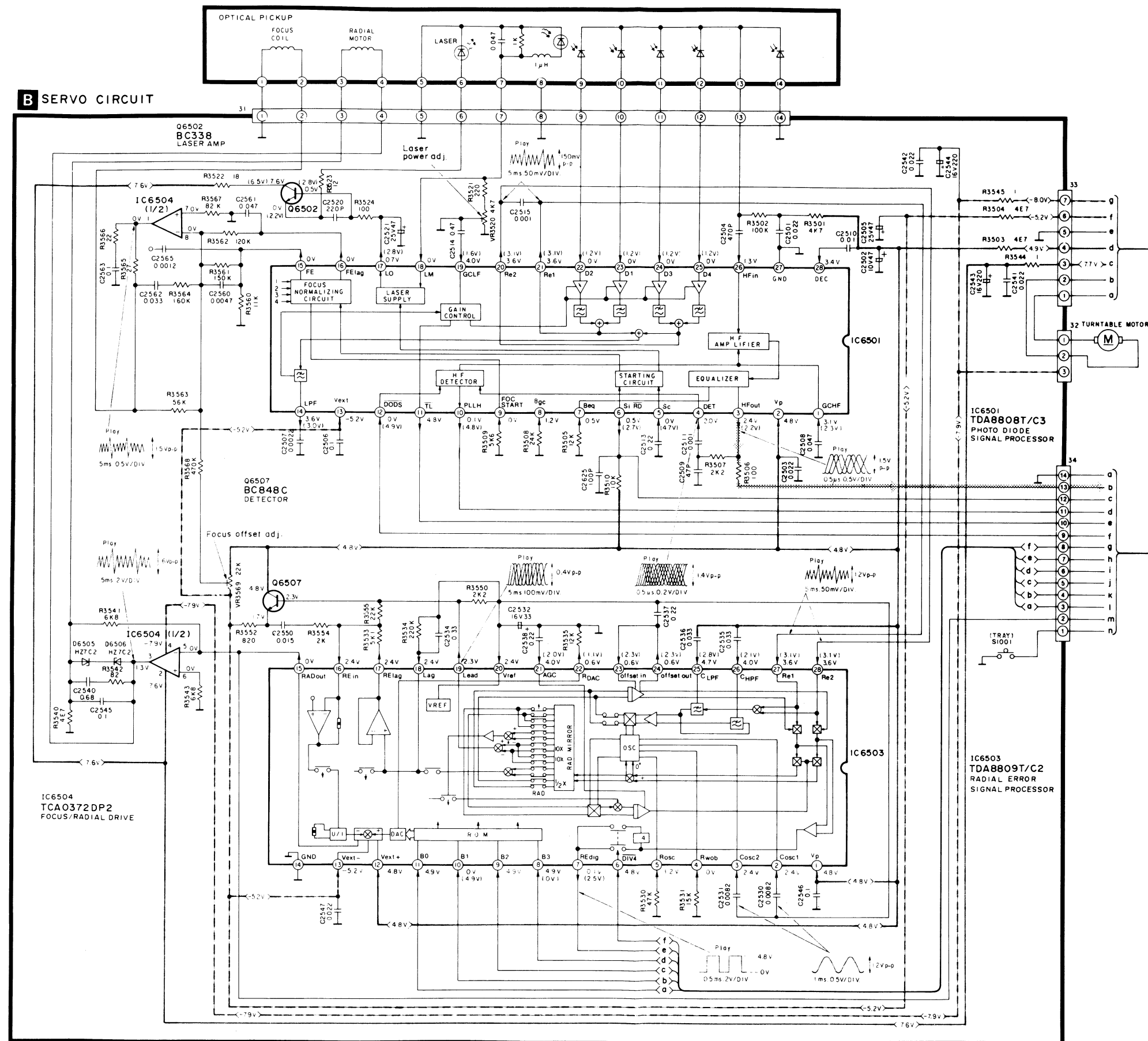
IC and LSI are sensitive to static electricity.

Secondary trouble can be prevented by taking care during repair.

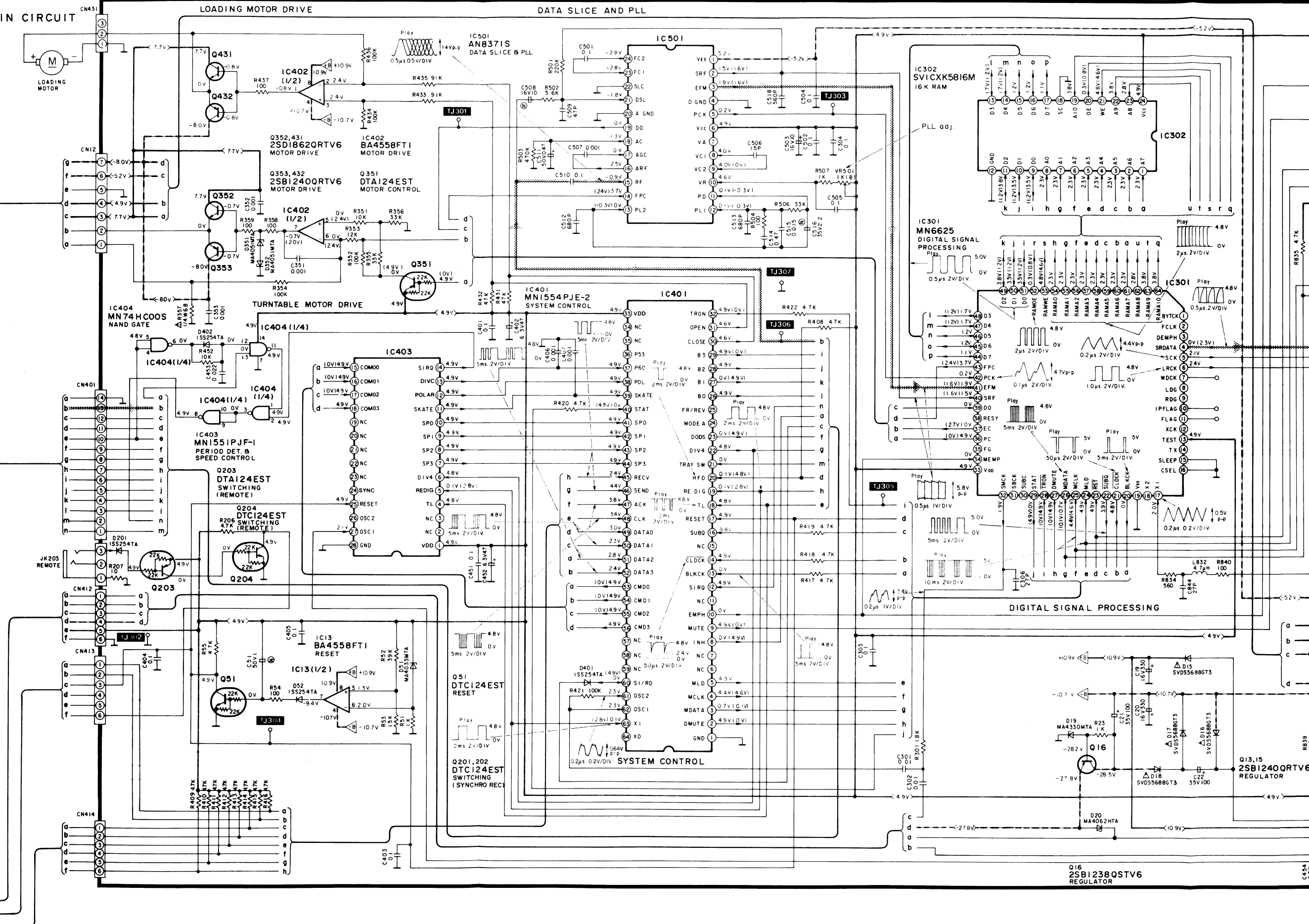
- Cover the parts boxes made of plastics with aluminum foil.
- Ground the soldering iron.
- Put a conductive mat on the work table.
- Do not touch the pins of IC or LSI with fingers directly.

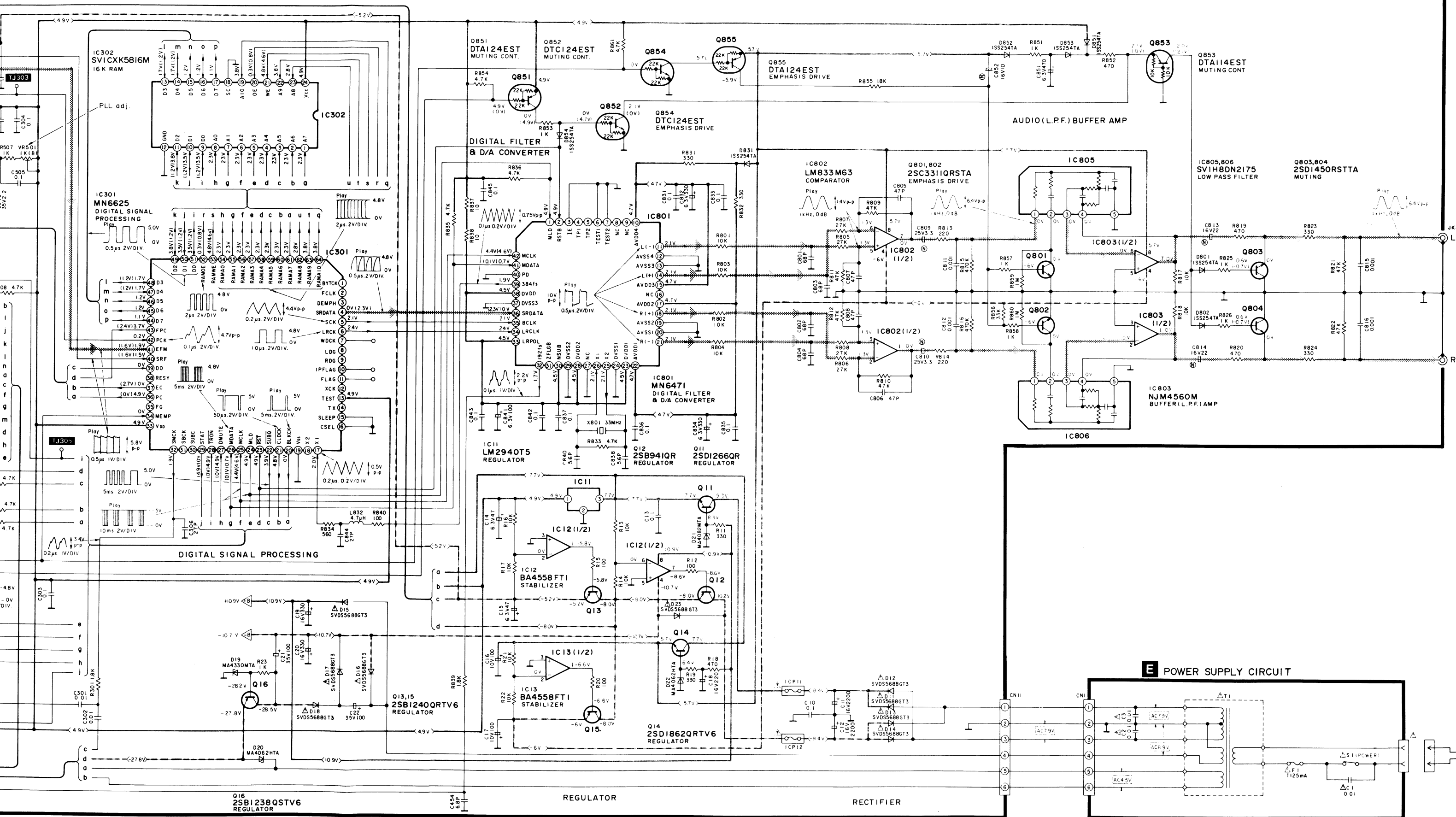


B SERVO CIRCUIT



C MAIN CIRCUIT





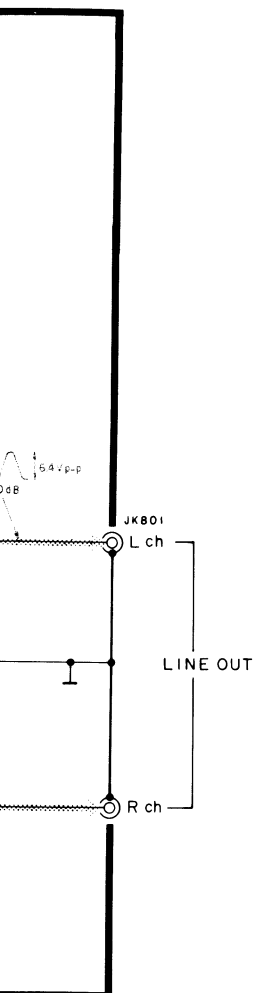
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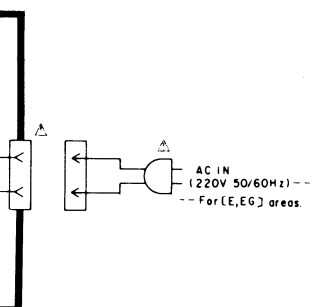
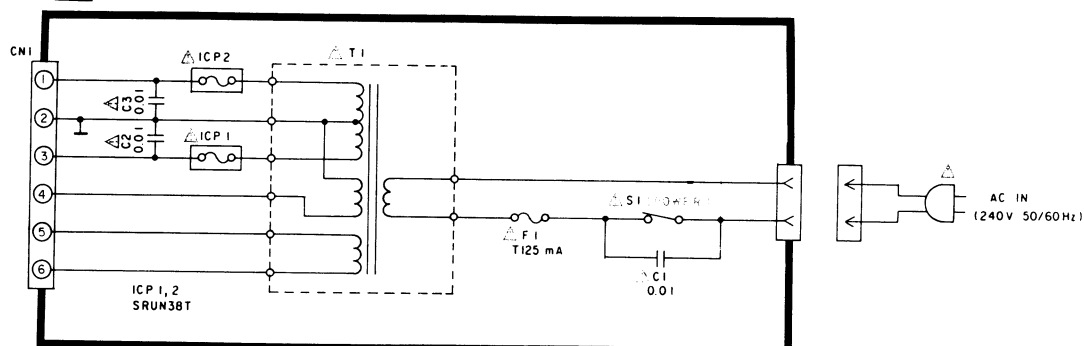
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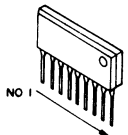
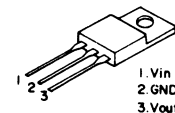
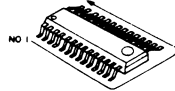
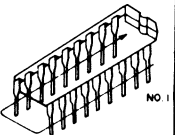
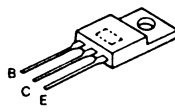
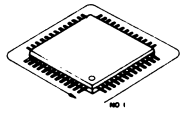
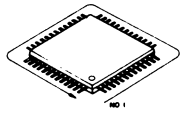
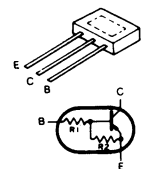
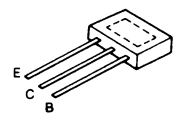
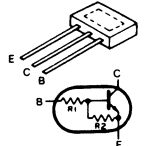
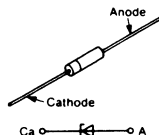
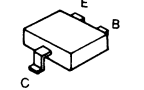
38



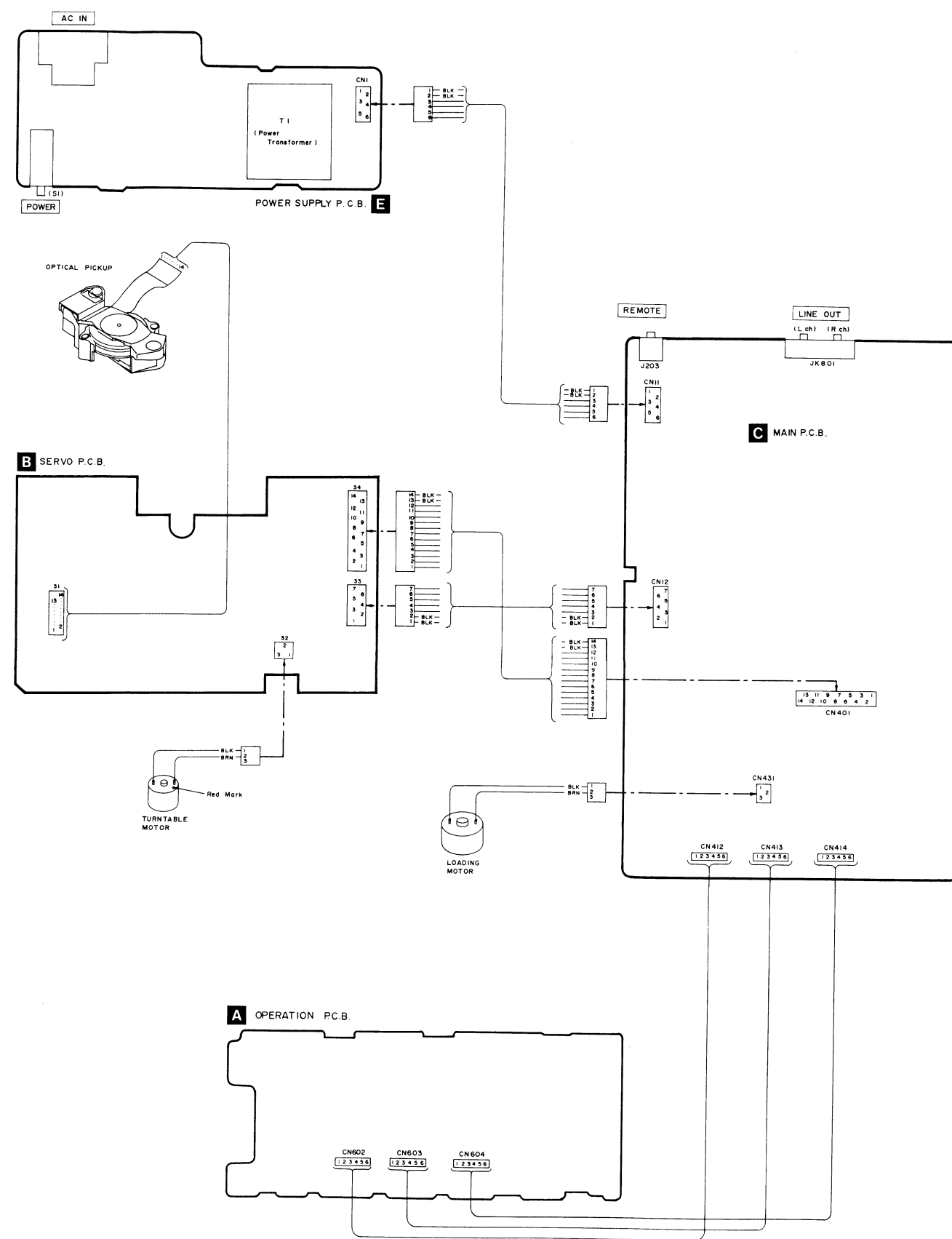
For (EB) area.

E POWER SUPPLY CIRCUIT

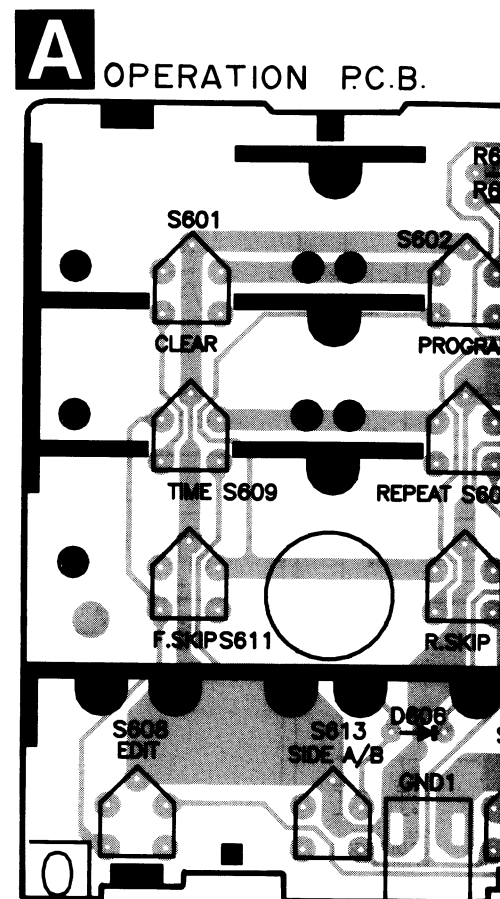
■ TERMINAL GUIDE OF IC's, TRANSISTORS AND DIODES

 SVIH8DN2175 5 Pin		 LM2940T5 1. Vin 2. GND 3. Vout
	LM833M	AN8371S 24 Pin
	NJM4560M 8 Pin	SVICXK5816M 24 Pin
	BA4558FT1	4822 209 73234 (TDA8808T) 28 Pin
	MN74HC00S 14 Pin	4822 209 73235 (TDA8809T) 28 Pin
	MN15283PJH 64 Pin	 2SB941QR, 2SD1266QR
	MN1551PJF-1 28 Pin	
	MN1554PJE-2 64 Pin	
	4822 209 72587 (TCA0372) 8 Pin	
 MN6471 42 Pin  MN6625 64 Pin	SRUF38T, SRUN15	4822 130 44121 (BC338)
 DTA124EST, DTA114EST		 2SD1450R, 2SC3311A-Q
 DTC124EST	2SB1238QSTV6, 2SD1862QRTV6, 2SB1240-P	1SS254, SVDS5688GT3
 MA4330M, MA4062H, MA4033M, MA4051M, MA4082M	 5322 130 42136 (BC848C)	

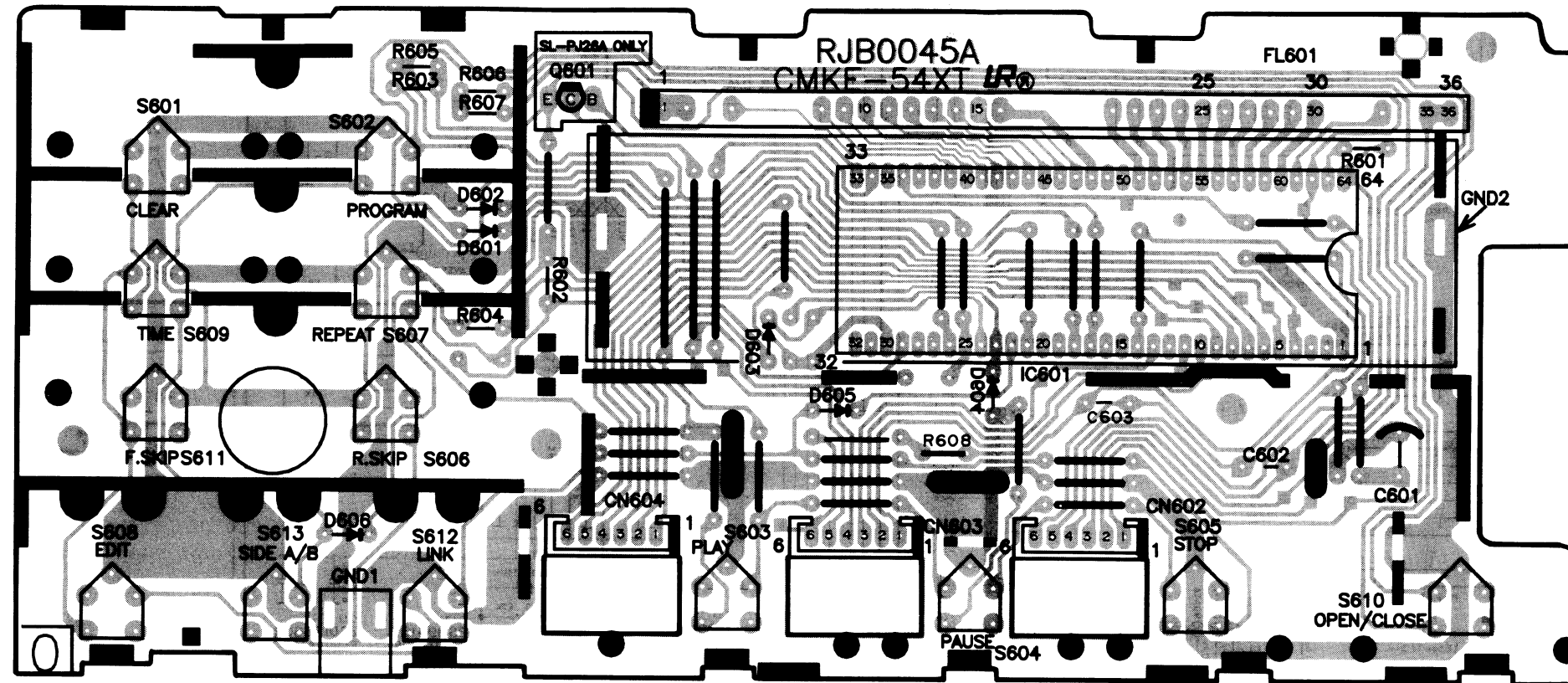
■ WIRING CONNECTION DIAGRAM

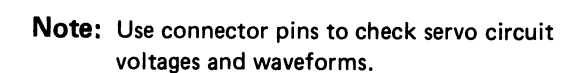


■ PRINTED CIRCUIT BOARDS



■ PRINTED CIRCUIT BOARDS

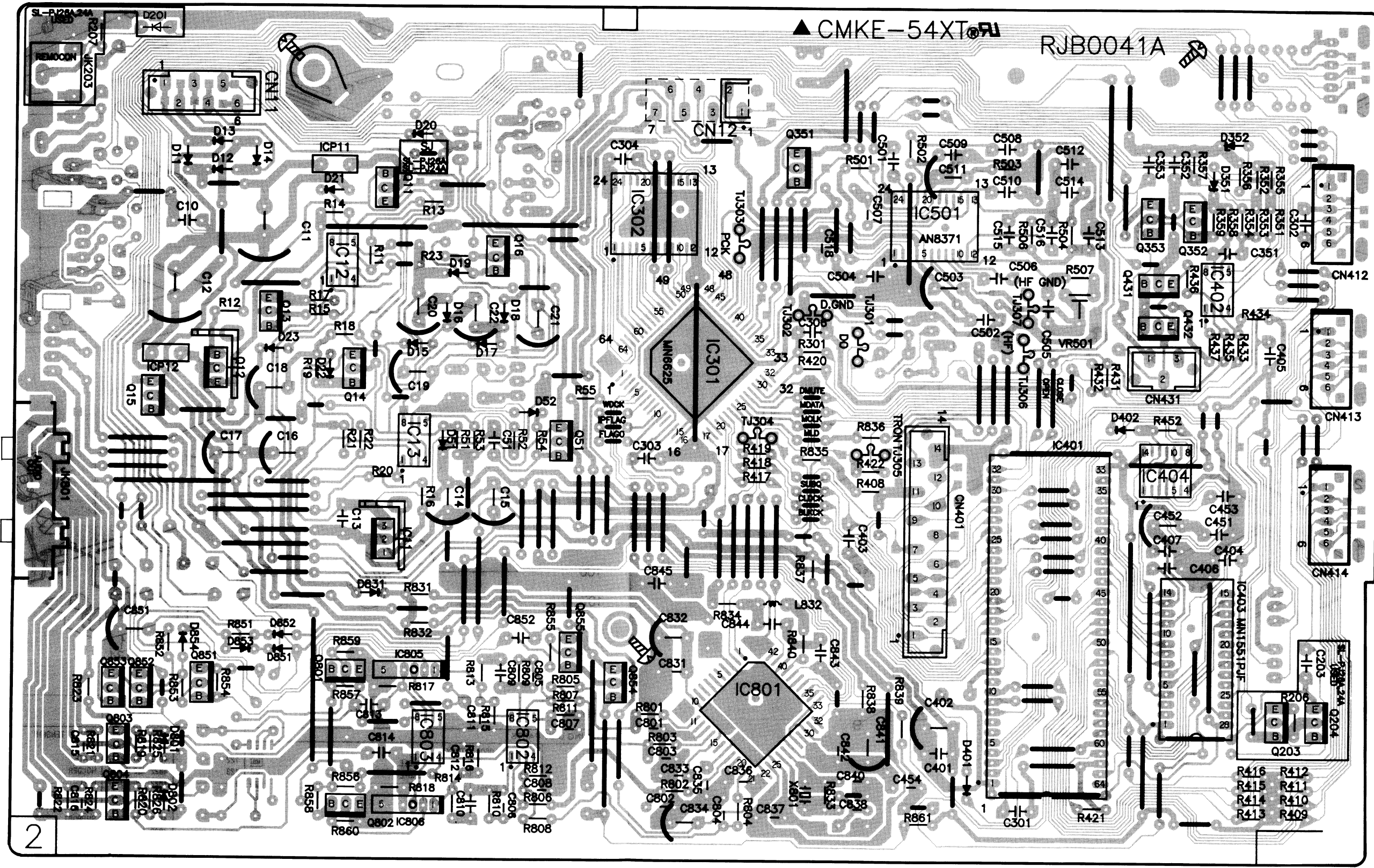
A OPERATION P.C.B.



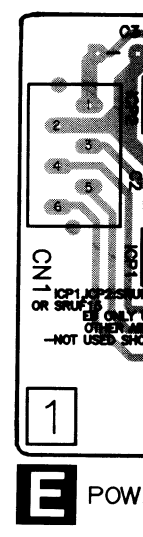
C MAIN P.C.B.

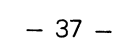
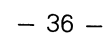
REMOTE

LINE OUT
(L ch)
(R ch)



2

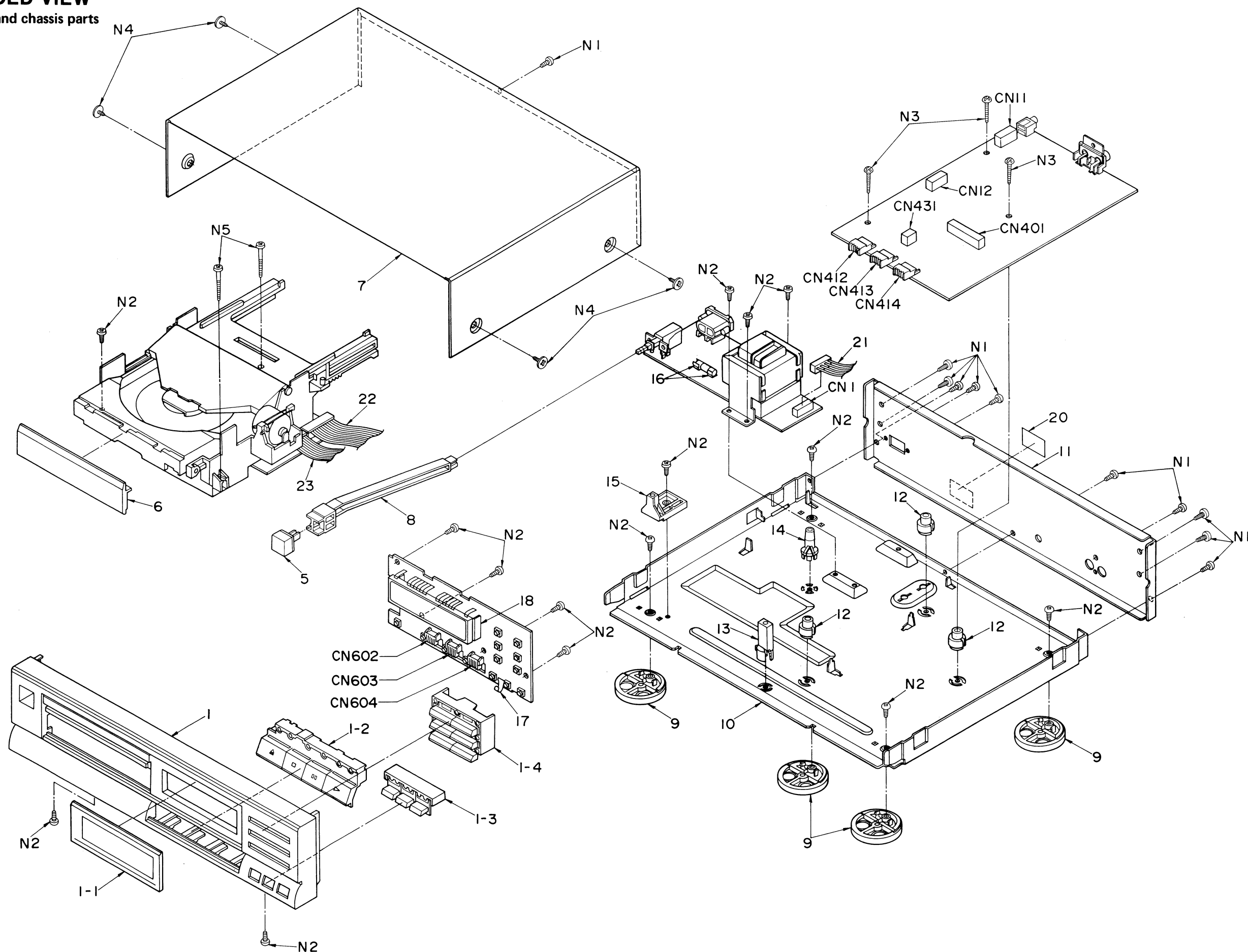




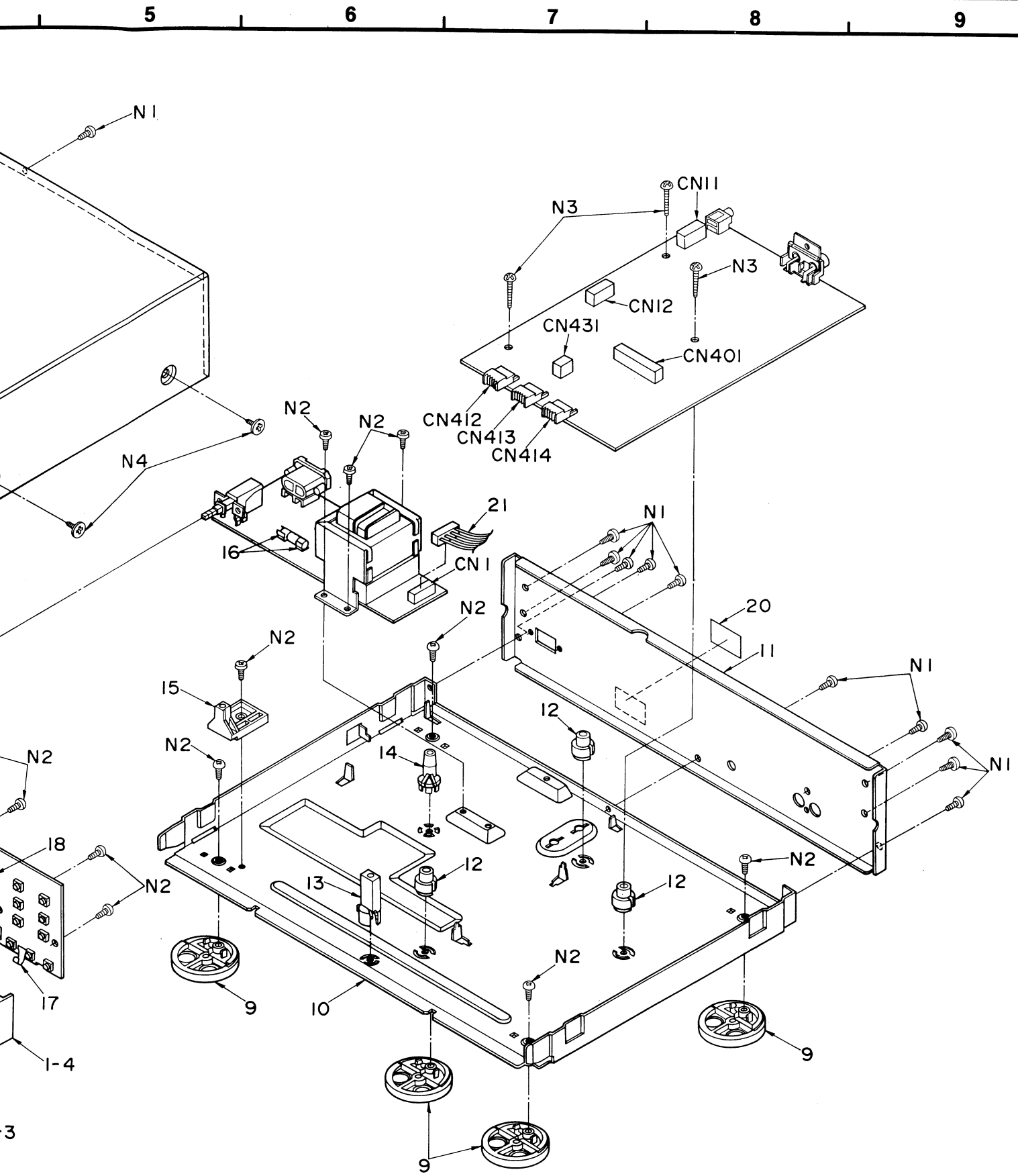
EXPLODED VIEW

• Cabinet and chassis parts

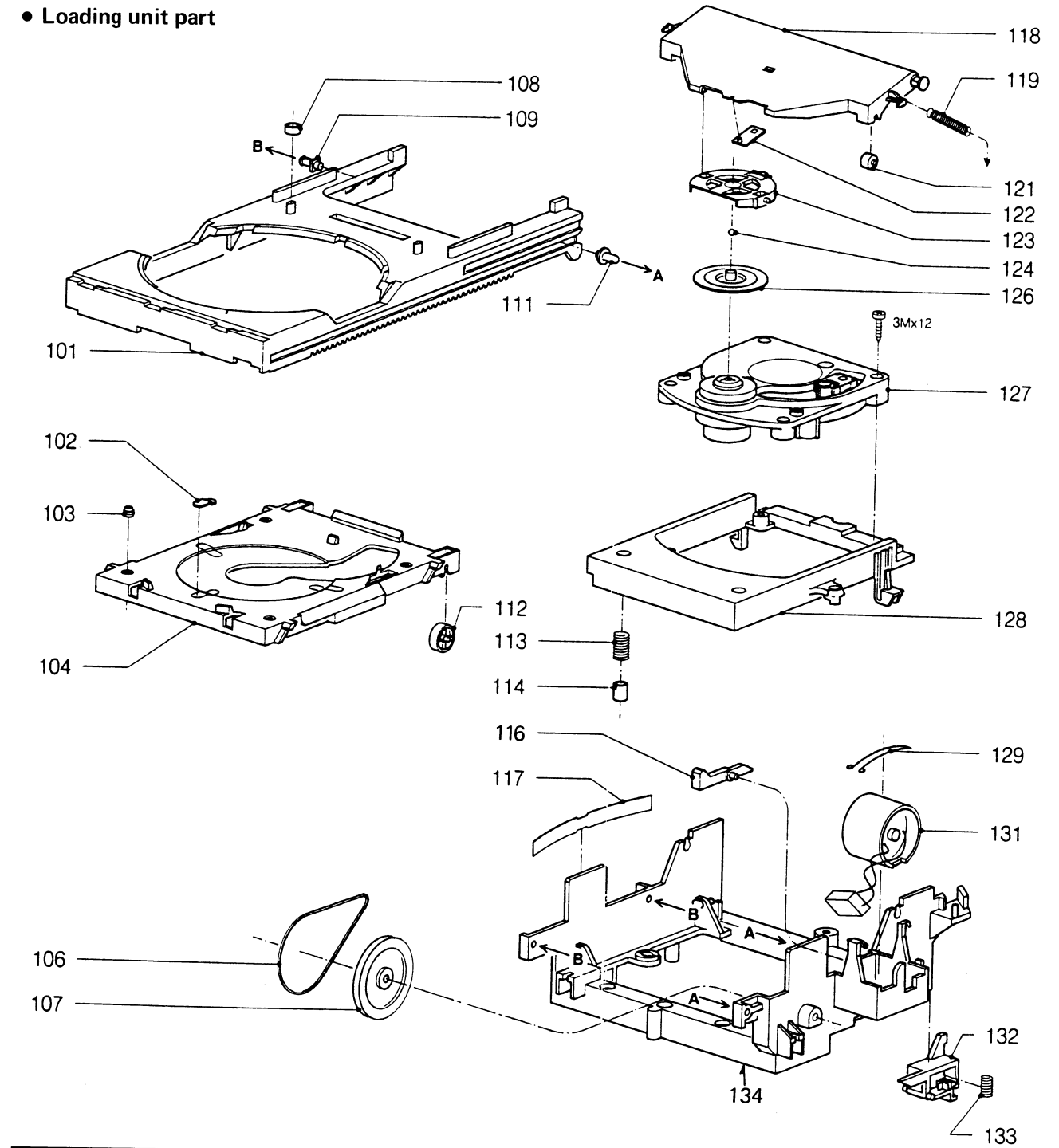
• Loading unit parts



Ref. No.	Part No.
LOADING UNIT PARTS	
101	4822 444 50
102	4822 325 50
103	4822 325 50
104	4822 466 92
106	4822 358 10
107	4822 522 32
108	4822 532 51
109	4822 402 61
111	4822 402 61
112	4822 528 90
113	4822 492 51
114	4822 466 61
116	4822 402 61
117	4822 492 63
118	4822 444 60



• Loading unit part



Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
LOADING UNIT PARTS					
101	4822 444 50603	TRAY	119	4822 492 32883	SPRING, TENSION
102	4822 325 50176	GROMMET, CABLE	121	4822 528 90639	ROLLER
103	4822 325 50177	GROMMET, CABLE	122	4822 466 92257	PLATE
104	4822 466 92251	PLATE	123	4822 402 61207	HOLDER
106	4822 358 10115	BELT, DRIVING	124	4822 520 40177	BALL
107	4822 522 32359	WHEEL, GEAR	126	4822 530 80503	RING, PRESSURE
108	4822 532 51518	RING, RUBBER	127	4822 691 30209	Optical pickup unit
109	4822 402 61081	GUIDE	128	4822 402 61196	SUPPORT
111	4822 402 61132	GUIDE	129	4822 492 63746	SPRING, CLAMPING
112	4822 528 90638	ROLLER	131	4822 361 20998	MOTOR
113	4822 492 51902	SPRING, COMPRES.	132	4822 402 50244	BRACKET
114	4822 466 61587	FOAM	133	4822 492 51935	SPRING, COMPRES.
116	4822 402 61107	LEVER	134	4822 464 50715	CHASSIS
117	4822 492 63659	SPRING, BLADE			
118	4822 444 60568	LID			

■ REPLACEMENT PARTS LIST

Notes : * Important safety notice :

Components identified by mark have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

* Bracketed indications in Remarks columns specify the area. (Refer to the first page for area.)

Parts without these indications can be used for all areas.

*** Warning : This product uses a laser diode. Refer to caution statements on page 3.**

* ACHTUNG :

Die Lasereinheit nicht zerlegen.

Die Lasereinheit darf nur gegen eine vom Hersteller spezifizierte Einheit ausgetauscht werden.

* **MB** indicates parts that are supplied by **MBV**.

Ref. No.	Part No.	Part Name & Description	Remarks
		CABINET AND CHASSIS	
1	RYP0040Z	FRONT PANEL ASS'Y	
1-1	RKWO025	ORNAMENT	
1-2	RGU0095	BUTTON MAIN	
1-3	RGU0096	BUTTON EDIT	
1-4	RGU0062	BUTTON SKIP	
5	SBC666-1	KNOB POWER	
6	RGK0046A	ORNAMENT	
7	RKMD015-K	CABINET BODY MB	
8	RMR0084	ROD MB	
9	SKL307-1	FOOT	
10	RMK0023	BOTTOM BOARD MB	
11	RGRO030	REAR PANEL ASS'Y MB	<E>
11	RGRO007E	REAR PANEL MB	<EG>
11	RGRO031	REAR PANEL ASS'Y MB	<EB>
12	SHE185-2	PCB SUPPORTER	
13	RMR0021	SPACER B MB	
14	RMR0020	SPACER A MB	
15	RMR0022	SPACER C MB	
16	SJT390	FUSE HOLDER	
17	SUSD144	EARTH PLATE	
18	SUWD139	BRACKET	
20	SQWD7	CAUTION (LASER)	
21	REX0006	FLAT CABLE ASS'Y MB	
22	REX0008	FLAT CABLE ASS'Y MB	
23	REX0007	FLAT CABLE ASS'Y MB	
N1	XTBS3+8JFZ1	SCREW	
N2	XTB3+8JFZ	SCREW	
N3	XTB3+16JFZ	SCREW	
N4	SNE2129-1	SCREW	
N5	XTB3+35JFZ	SCREW	

Ref. No.	Part No.	Part Name & Description	Remarks
		ACCESSORIES	
A1	RQT0089E	INSTRUCTION MANUAL MB	<E>
A1	RQT0089G	INSTRUCTION MANUAL MB	<E>
A1	RQT0089D	INSTRUCTION MANUAL MB	<EG>
A1	RQT0089B	INSTRUCTION MANUAL MB	<EB>
A2	SJP2249-3	OUTPUT CORD	
A3	SJA187	POWER CORD	<E, EG> △
A3	SJA193	POWER CORD	<EB> △
A4	SJP2257T	SYNCHRO REC CORD	
A5	RQCA0002	CAUTION MB	
A6	RQLA0013	CAUTION (LOCK) MB	
A7	RFA0011	ANGLE	
		PACKING MATERIAL	
P1	RPG0108	CARTON BOX MB	
P2	RPN0073	CUSHION MB	
P3	XZB60X60A01	PROTECTION BAG (UNIT)	
P4	XZB23X35C03	PROTECTION BAG (F. B)	
P5	RPH0026	PROTECTION SHEET MB	
P6	XZB26X17C03	PROTECTION BAG (CORD)	
P7	RMR0024	CLAMPER MB	

Ref. No.	Part No.	Part Name & Description	Remarks	Ref. No.	Part No.	Part Name & Description	Remarks
		INTEGRATED CIRCUITS					
IC11	LM2940T5	IC, REGULATOR		D11	SVDS5688GT3	DIODE	△
IC12	BA4558FT1	IC, STABILIZER		D12	SVDS5688GT3	DIODE	△
IC13	BA4558FT1	IC, RESET		D13	SVDS5688GT3	DIODE	△
IC301	MN6625	IC, SIGNAL PROCESSING		D14	SVDS5688GT3	DIODE	△
IC302	SVICKX5816M	IC, 16K RAM		D15	SVDS5688GT3	DIODE	△
IC401	MN1554PJE-2	IC, SYSTEM CONTROL		D16	SVDS5688GT3	DIODE	△
IC402	BA4558FT1	IC, MOTOR DRIVE		D17	SVDS5688GT3	DIODE	△
IC403	MN1551PJF-1	IC, SPEED CONTROL		D18	SVDS5688GT3	DIODE	△
IC404	MN74HC00S	IC, NAND DATE		D19	MA4330MTA	DIODE	
IC501	AN8371S	IC, DATA SLICE & PLL		D20	MA4062HTA	DIODE	
IC601	MN15283PJH	IC, FL DRIVE&SIGNAL GENERATOR		D21	MA4082MTA	DIODE	
IC801	MN6471	IC, DF & DAC		D22	MA4062HTA	DIODE	
IC802	LM833M63	IC, COMPARATOR		D23	SVDS5688GT3	DIODE	△
IC803	NJM4560M	IC, BUFFER		D51	MA4033MTA	DIODE	
IC805	H8DN2175	IC, L. P. F.		D52	1SS254TA	DIODE	
IC806	H8DN2175	IC, L. P. F.		D201	1SS254TA	DIODE	
ICP1	SRUN38T	IC, PROTECTOR	<EB> △	D351	MA4051MTA	DIODE	
ICP2	SRUN38T	IC, PROTECTOR	<EB> △	D352	MA4051MTA	DIODE	
ICP11	SRUN15T	IC, PROTECTOR	△	D401	1SS254TA	DIODE	
ICP12	SRUN15T	IC, PROTECTOR	△	D402	1SS254TA	DIODE	
		TRANSISTORS		D601	1SS254TA	DIODE	
				D602	1SS254TA	DIODE	
Q11	2SD1266QR	TRANSISTOR		D603	1SS254TA	DIODE	
Q12	2SB941QR	TRANSISTOR		D604	1SS254TA	DIODE	
Q13	2SB1240QRTV6	TRANSISTOR		D605	1SS254TA	DIODE	
Q14	2SD1862QRTV6	TRANSISTOR		D606	1SS254TA	DIODE	
Q15	2SB1240QRTV6	TRANSISTOR		D801	1SS254TA	DIODE	
Q16	2SB1238QSTV6	TRANSISTOR		D802	1SS254TA	DIODE	
Q51	DTC124EST	TRANSISTOR		D831	1SS254TA	DIODE	
Q203	DTA124EST	TRANSISTOR		D851	1SS254TA	DIODE	
Q204	DTC124EST	TRANSISTOR		D852	1SS254TA	DIODE	
Q351	DTA124EST	TRANSISTOR		D853	1SS254TA	DIODE	
Q352	2SD1862QRTV6	TRANSISTOR		D854	1SS254TA	DIODE	
Q353	2SB1240QRTV6	TRANSISTOR					
Q431	2SD1862QRTV6	TRANSISTOR				VARIABLE RESISTORS	
Q432	2SB1240QRTV6	TRANSISTOR		VR501	EVND8AA02B13	V. RESISTOR, PLL ADJ.	
Q601	DTA124EST	TRANSISTOR					
Q801	2SC3311QRSTA	TRANSISTOR				COILS	
Q802	2SC3311QRSTA	TRANSISTOR		L832	ELEPK4R7KA	COIL	
Q803	2SD1450RSTTA	TRANSISTOR					
Q804	2SD1450RSTTA	TRANSISTOR				TRANSFORMERS	
Q851	DTA124EST	TRANSISTOR		T1	RTP1V4E001-J	TRANSFORMER [MB] <E. EG>	△
Q852	DTC124EST	TRANSISTOR		T1	RTP1V4E002-J	TRANSFORMER [MB] <EB>	△
Q853	DTA114EST	TRANSISTOR					
Q854	DTC124EST	TRANSISTOR				OSCILLATORS	
Q855	DTA124EST	TRANSISTOR					
		DIODES		X801	SVQ49U338S	OSCILLATOR	

Ref. No.	Part No.	Part Name & Description	Remarks	Ref. No.	Part No.	Part Name & Description	Remarks
		DISPLAY TUBE				CONNECTOR AND SOCKET	
FL601	RSL0002F	DISPLAY TUBE		CN1	RJT001H006	CONNECTOR [MB]	
		FUSES		CN11	RJT001H006	CONNECTOR [MB]	
F 1	XBA2C012TB0	FUSE (250V. T125mA)	△	CN12	RJT001H007	CONNECTOR [MB]	
F 2	XBA2C08TB0	FUSE (250V. T800mA)	<E. EG> △	CN401	RJT001H014	CONNECTOR [MB]	
		SWITCHES		CN412	SJS50680WL	SOCKET	
S1	ESB8249V	POWER	△	CN413	SJS50680WL	SOCKET	
S601	EVQQS705G	CLEAR		CN414	SJS50680WL	SOCKET	
S602	EVQQS705G	PROGRAM		CN431	RJT001H003	CONNECTOR	
S603	EVQQS705G	PLAY		CN602	SJT30647WL	CONNECTOR	
S604	EVQQS705G	PAUSE		CN603	SJT30647WL	CONNECTOR	
S605	EVQQS705G	STOP		CN604	SJT30647WL	CONNECTOR	
S606	EVQQS705G	F. SKIP/SEARCH				JACKS	
S607	EVQQS705G	REPEAT		JK1	SJS9236	AC IN LET	△
S608	EVQQS705G	EDIT		JK203	SJJ130-2	REMOTE CONTROL	
S609	EVQQS705G	TIME MODE		JK801	SJFD4	OUTPUT	
S610	EVQQS705G	OPEN/CLOSE					
S611	EVQQS705G	R. SKIP/SEARCH					
S612	EVQQS705G	LINK					
S613	EVQQS705G	SIDE A/B					

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
INTEGRATED CIRCUITS			DIODES		
IC6501	4822 209 73234	I.C. PHOTO DIODE SIGNAL PROCESSOR [MB]	D6505	4822 130 81101	DIODE [MB]
IC6503	4822 209 73235	I.C. RADIAL ERROR SIGNAL PROCESSOR [MB]	D6506	4822 130 81101	DIODE [MB]
IC6504	4822 209 72587	I.C. FOCUS/RADIAL DRIVE [MB]	VARIABLE RESISTORS		
TRANSISTORS			VR3520	4822 101 10685	V.R. LASER POWER ADJ. [MB]
Q6502	4822 130 44121	TRANSISTOR [MB]	VR3569	4822 100 20522	V.R. FOCUS OFFSET ADJ. [MB]
Q6507	5322 130 42136	TRANSISTOR [MB]	SWITCH		
			S1001	4822 276 12523	SW, TRAY [MB]

RESISTORS AND CAPACITORS

Notes : * Important safety notice :

Components identified by Δ mark have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

* Bracketed indications in Remarks columns specify the area. (Refer to the first page for area.)

Parts without these indications can be used for all areas.

* [MB] indicated parts that are supplied by MBV.

Numbering System For Resistors

Example:

ERD	25	F	J	102
Type	Wattage (1/4W)	Shape	Tolerance	Value (1K Ω)
ERX	2	AN	J	471
Type	Wattage (2W)	Shape	Tolerance	Value (470 Ω)

Numbering System For Capacitors

Example:

ECKD	1H	102	Z	F
Type	Voltage (50V)	Value (0.001 μ F)	Tolerance	Unique
ECEA	50	M		330
Type	Voltage (50V)	Characteristics		Value (33 μ F)

● Capacity values are in microfarads (μ F) unless specified otherwise, P = Pico-farads (pF) F = Farads (F).

● Resistance values are in ohms (Ω), unless specified otherwise, 1K = 1,000 Ω , 1M = 1,000k Ω

Resistor Type	Wattage	Tolerance
ERD : Carbon	10 : 1/8W 12 : 1/2W	J : $\pm 5\%$
ERG : Metal Oxide	14 : 1/4W 25 : 1/4W	F : $\pm 1\%$
ERQ : Fuse Type Metal	1A : 1W 18 : 1/8W	G : $\pm 2\%$
ERX : Metal Film	S2 : 1/4W S1 : 1/2W	J : $\pm 5\%$
ERD L : Carbon (chip)	2F : 1/4W 50 : 1/2W	K : $\pm 10\%$
ERO K : Metal Film (chip)	2A : 2W 3A : 3W	M : $\pm 20\%$
ERC : Solid	6G : 1/10W 8G : 1/8W	
ERF : Incombustible Box-Shaped		
ERM : Wire-Wound		
RRJ : Chip Resistor		
ERJ : Chip Resistor		

Capacitor Type	Voltage	Tolerance
ECE : Electrolytic	0J : 6.3V 1A : 10V	K : $\pm 10\%$
ECCD : Ceramic	1C : 16V 1E : 25V	M : $\pm 20\%$
ECKD : Ceramic Capacitor	1H : 50V 1V : 35V	Z : $\pm 80\%$
ECQM : Polyester	50 : 50V 05 : 50V	-20
ECQP : Polypropylene	2H : 500V 2A : 100V	J : $\pm 5\%$
ECG : Ceramic	1 : 100V 1J : 63V	G : $\pm 2\%$
ECEA N : Non Polar Electrolytic	KC : 400V AC	F : $\pm 1\%$
QCU : Ceramic (Chip Type)	KC : 125V AC	C : ± 0.25 pF
ECUX : Ceramic (Chip Type)	(UL)	D : ± 0.5 pF
ECF : Semiconductor		
EECW : Liquid electrolyte double layer capacitor		

Ref. No.	Part No.	Part Name & Description	Remarks	Ref. No.	Part No.	Part Name & Description	Remarks
		RESISTORS					
R11	ERDS2TJ331T	C. RESISTOR 1/4W 330		R354	ERDS2TJ104T	C. RESISTOR 1/4W 100K	
R12	ERDS2TJ101T	C. RESISTOR 1/4W 100		R355	ERDS2TJ333T	C. RESISTOR 1/4W 33K	
R13	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R356	ERDS2TJ333T	C. RESISTOR 1/4W 33K	
R14	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R357	ERD25FVJ6R8T	C. RESISTOR 1/4W 6.8	Δ
R15	ERDS2TJ101T	C. RESISTOR 1/4W 100		R358	ERDS2TJ101T	C. RESISTOR 1/4W 100	
R16	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R359	ERDS2TJ101T	C. RESISTOR 1/4W 100	
R17	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R408	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R18	ERDS2TJ471T	C. RESISTOR 1/4W 470		R409	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R19	ERDS2TJ331T	C. RESISTOR 1/4W 330		R410	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R20	ERDS2TJ101T	C. RESISTOR 1/4W 100		R411	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R21	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R412	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R22	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R413	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R23	ERDS2TJ102T	C. RESISTOR 1/4W 1K		R414	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R51	ERDS2TJ102T	C. RESISTOR 1/4W 1K		R415	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R52	ERDS2TJ393T	C. RESISTOR 1/4W 39K		R416	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R53	ERDS2TJ153T	C. RESISTOR 1/4W 15K		R417	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R54	ERDS2TJ101T	C. RESISTOR 1/4W 100		R418	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R55	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		R419	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R206	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		R420	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R207	ERDS2TJ100T	C. RESISTOR 1/4W 10		R421	ERDS2TJ104T	C. RESISTOR 1/4W 100K	
R301	ERDS2TJ182T	C. RESISTOR 1/4W 1.8K		R422	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R351	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R431	ERDS2TJ473T	C. RESISTOR 1/4W 47K	
R352	ERDS2TJ104T	C. RESISTOR 1/4W 100K		R432	ERDS2TJ473T	C. RESISTOR 1/4W 47K	
R353	ERDS2TJ123T	C. RESISTOR 1/4W 12K		R433	ERDS2TJ913T	C. RESISTOR 1/4W 91K	
				R434	ERDS2TJ104T	C. RESISTOR 1/4W 100K	
				R435	ERDS2TJ913T	C. RESISTOR 1/4W 91K	

Ref. No.	Part No.	Part Name & Description	Remarks	Ref. No.	Part No.	Part Name & Description	Remarks
R436	ERDS2TJ104T	C. RESISTOR 1/4W 100K		R839	ERDS2TJ182T	C. RESISTOR 1/4W 1.8K	
R437	ERDS2TJ101T	C. RESISTOR 1/4W 100		R840	ERDS2TJ101T	C. RESISTOR 1/4W 100	
R452	ERDS2TJ103T	C. RESISTOR 1/4W 10K		R851	ERDS2TJ102T	C. RESISTOR 1/4W 1K	
R501	ERDS2TJ224T	C. RESISTOR 1/4W 220K		R852	ERDS2TJ471T	C. RESISTOR 1/4W 470	
R502	ERDS2TJ562T	C. RESISTOR 1/4W 5.6K		R853	ERDS2TJ102T	C. RESISTOR 1/4W 1K	
R503	ERDS2TJ474T	C. RESISTOR 1/4W 470K		R854	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R504	ERDS2TJ101T	C. RESISTOR 1/4W 100		R855	ERDS2TJ183T	C. RESISTOR 1/4W 18K	
R506	ERDS2TJ333T	C. RESISTOR 1/4W 33K		R856	ERDS2TJ333T	C. RESISTOR 1/4W 33K	
R507	ERDS2TJ102T	C. RESISTOR 1/4W 1K		R857	ERDS2TJ102T	C. RESISTOR 1/4W 1K	
R601	ERDS2TJ104T	C. RESISTOR 1/4W 100K		R858	ERDS2TJ102T	C. RESISTOR 1/4W 1K	
R602	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		R859	ERDS2TJ105T	C. RESISTOR 1/4W 1M	
R603	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		R860	ERDS2TJ105T	C. RESISTOR 1/4W 1M	
R604	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		R861	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K	
R605	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K					
R606	ERDS2TJ100T	C. RESISTOR 1/4W 10				CAPACITORS	
R607	ERDS2TJ100T	C. RESISTOR 1/4W 10					
R608	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C1	ECKDKC103PF2	. CAPACITOR 125V 0.01U	△
R609	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C2	ECFR1H103KB	S. CAPACITOR 50V 0.01U	△
R801	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C3	ECFR1H103KB	S. CAPACITOR 50V 0.01U	△
R802	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C10	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R803	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C11	ECEA1CU222E	E. CAPACITOR 16V 2200U	
R804	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C12	ECEA1CU222E	E. CAPACITOR 16V 2200U	
R805	ERDS2TJ273T	C. RESISTOR 1/4W 27K		C13	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R806	ERDS2TJ273T	C. RESISTOR 1/4W 27K		C14	ECEA0JK470B	E. CAPACITOR 6.3V 47U	
R807	ERDS2TJ273T	C. RESISTOR 1/4W 27K		C15	ECEA0JK470B	E. CAPACITOR 6.3V 47U	
R808	ERDS2TJ273T	C. RESISTOR 1/4W 27K		C16	ECEA1AK101B	E. CAPACITOR 10V 100U	
R809	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C17	ECEA1AK101B	E. CAPACITOR 10V 100U	
R810	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C18	ECEA1CU221B	E. CAPACITOR 16V 220U	
R811	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C19	ECEA1CU331B	E. CAPACITOR 16V 330U	
R812	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C20	ECEA1CU331B	E. CAPACITOR 16V 330U	
R813	ERDS2TJ221T	C. RESISTOR 1/4W 220		C21	ECEA1VU101B	E. CAPACITOR 35V 100U	
R814	ERDS2TJ221T	C. RESISTOR 1/4W 220		C22	ECEA1VU101B	E. CAPACITOR 35V 100U	
R815	ERDS2TJ474T	C. RESISTOR 1/4W 470K		C51	ECEA1HKN010B	E. CAPACITOR 50V 1U	
R816	ERDS2TJ474T	C. RESISTOR 1/4W 470K		C301	ECBT1C103NS5	. CAPACITOR 16V 0.01U	
R817	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C302	ECBT1C103NS5	. CAPACITOR 16V 0.01U	
R818	ERDS2TJ103T	C. RESISTOR 1/4W 10K		C303	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R819	ERDS2TJ471T	C. RESISTOR 1/4W 470		C304	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R820	ERDS2TJ471T	C. RESISTOR 1/4W 470		C306	ECBT1H270J5	. CAPACITOR 50V 27P	
R821	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C351	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
R822	ERDS2TJ473T	C. RESISTOR 1/4W 47K		C352	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
R823	ERDS2TJ331T	C. RESISTOR 1/4W 330		C353	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
R824	ERDS2TJ331T	C. RESISTOR 1/4W 330		C401	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R825	ERDS2TJ102T	C. RESISTOR 1/4W 1K		C402	ECEA0JK470B	E. CAPACITOR 6.3V 47U	
R826	ERDS2TJ102T	C. RESISTOR 1/4W 1K		C403	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R831	ERDS2TJ331T	C. RESISTOR 1/4W 330		C404	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R832	ERDS2TJ331T	C. RESISTOR 1/4W 330		C405	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R833	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		C406	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
R834	ERDS2TJ561T	C. RESISTOR 1/4W 560		C407	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
R835	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		C451	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
R836	ERDS2TJ472T	C. RESISTOR 1/4W 4.7K		C452	ECEA0JK470B	E. CAPACITOR 6.3V 47U	
R837	ERDS2TJ100T	C. RESISTOR 1/4W 10		C453	ECFR1H223KB	S. CAPACITOR 50V 0.022U	
R838	ERDS2TJ100T	C. RESISTOR 1/4W 10		C454	ECBT1H6R8K5	. CAPACITOR 50V 6.8P	

Ref. No.	Part No.	Part Name & Description	Remarks
C501	ECQM1H104KF3	P. CAPACITOR 50V 0.1U	
C502	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C503	ECEA1CK100B	E. CAPACITOR 16V 10U	
C504	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C505	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C506	ECBT1H150JC5	. CAPACITOR 50V 15P	
C507	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C508	ECEA1CKN100B	E. CAPACITOR 16V 10U	
C509	ECBT1H470J5	. CAPACITOR 50V 47P	
C510	ECQM1H104KF3	P. CAPACITOR 50V 0.1U	
C511	ECEA1HKAR47B	E. CAPACITOR 50V 47P	
C512	ECBT1H681KB5	. CAPACITOR 50V 680P	
C513	ECBT1H681KB5	. CAPACITOR 50V 680P	
C514	ECQV1H474JZ3	P. CAPACITOR 50V 0.47U	
C515	ECQM1H153KF3	P. CAPACITOR 50V 0.015U	
C516	ECEA1VKN2R2B	E. CAPACITOR 35V 2.2U	
C518	ECBT1H561KB5	. CAPACITOR 50V 560P	
C601	ECEA0JK470B	E. CAPACITOR .6. 3V 47U	
C602	ECBT1E223ZF5	. CAPACITOR 25V 0.022U	
C603	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C801	ECBT1H680J5	. CAPACITOR 50V 68P	
C802	ECBT1H680J5	. CAPACITOR 50V 68P	
C803	ECBT1H680J5	. CAPACITOR 50V 68P	
C804	ECBT1H680J5	. CAPACITOR 50V 68P	
C805	ECBT1H470J5	. CAPACITOR 50V 47P	
C806	ECBT1H470J5	. CAPACITOR 50V 47P	

Ref. No.	Part No.	Part Name & Description	Remarks
C807	ECBT1H470J5	. CAPACITOR 50V 47P	
C808	ECBT1H470J5	. CAPACITOR 50V 47P	
C809	ECEA1EKN3R3B	E. CAPACITOR 25V 3.3U	
C810	ECEA1EKN3R3B	E. CAPACITOR 25V 3.3U	
C811	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C812	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C813	ECEA1CKN220B	E. CAPACITOR 16V 22U	
C814	ECEA1CKN220B	E. CAPACITOR 16V 22U	
C815	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C816	ECBT1H102KB5	. CAPACITOR 50V 0.001U	
C831	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C832	ECEA0JU331B	E. CAPACITOR 6.3V 330U	
C833	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C834	ECEA0JU331B	E. CAPACITOR 6.3V 330U	
C835	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C836	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C837	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C838	ECBT1H5R6K5	. CAPACITOR 50V 5.6P	
C840	ECBT1H5R6K5	. CAPACITOR 50V 5.6P	
C841	ECEA0JK101B	E. CAPACITOR 6.3V 100U	
C842	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C843	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C844	ECBT1H270J5	. CAPACITOR 50V 27P	
C845	ECFR1E104ZF5	S. CAPACITOR 25V 0.1U	
C851	ECEA0JU471B	E. CAPACITOR 6.3V 470U	
C852	ECEA1CKN100B	E. CAPACITOR 16V 10U	

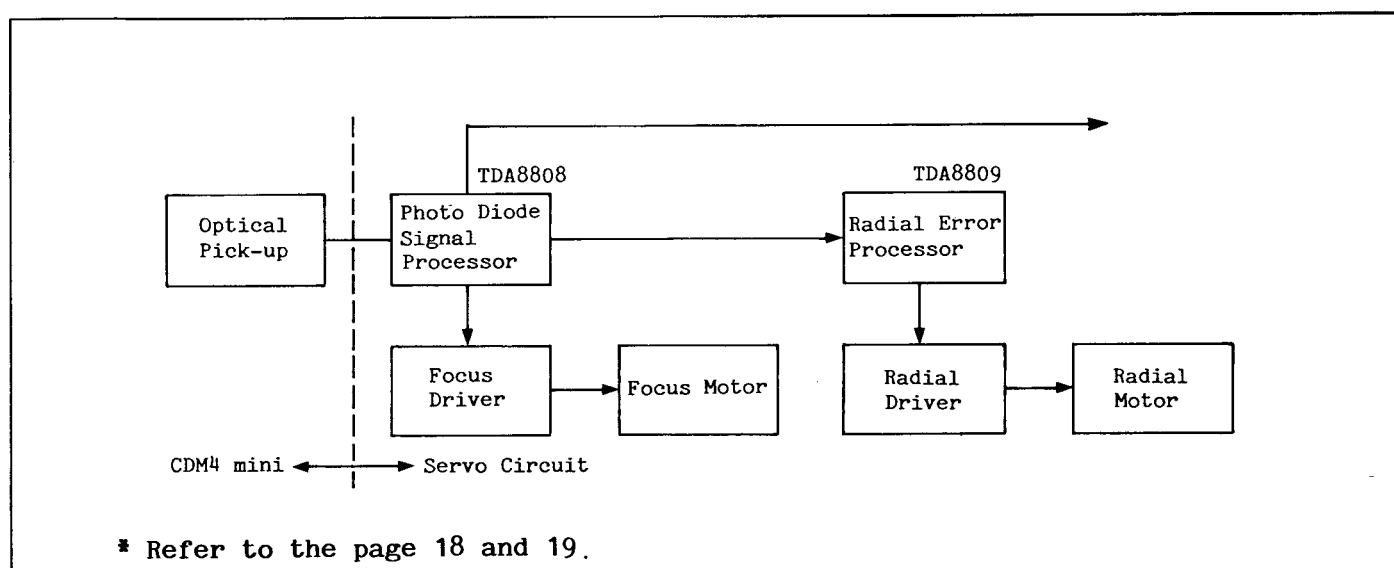
Ref. No.	Part No.	Value.	Ref. No.	Part No.	Value.	Ref. No.	Part No.	Value.
RESISTORS								
R3501	4822 116 52426	4K7 1/2	R3552	4822 111 90171	820 1/8	C2514	4822 121 51252	0.47 100
R3502	4822 111 90214	100K 1/8	R3554	4822 116 90421	2K 1/8	C2515	4822 122 31746	0.001 50
R3503	4822 111 30499	4E7 1/3	R3555	4822 111 90251	22K 1/8	C2520	4822 122 31965	220P 63
R3504	4822 111 30499	4E7 1/3	R3560	4822 111 91494	11K 1/8	C2521	4822 124 22027	47 2.5
R3505	4822 111 90253	12K 1/8	R3561	4822 116 90417	150K 1/8	C2530	4822 121 51321	0.0082 63
R3506	5322 111 90091	100 1/8	R3562	4822 116 52845	120K 3/5	C2531	4822 121 51321	0.0082 63
R3507	4822 111 90248	2K2 1/8	R3563	4822 111 90573	56K 1/8	C2532	4822 124 40272	33 16
R3508	4822 111 90512	24K 1/8	R3564	4822 111 91495	160K 1/8	C2534	5322 121 42661	0.33 63
R3509	4822 111 90572	5K6 1/8	R3565	4822 116 52354	27 1/2	C2535	5322 122 31848	0.033 63
R3510	4822 111 90249	10K 1/8	R3566	4822 111 90186	22 1/8	C2536	5322 122 31848	0.033 63
R3521	4822 111 90178	220 1/8	R3567	4822 116 52478	82K 1/2	C2537	4822 121 42245	0.22 63
R3522	4822 111 30515	18 1/3	R3568	4822 111 90161	470K 1/8	C2538	4822 121 42245	0.22 63
R3523	4822 111 30511	12 1/3	R3801	4822 111 90163	OE	C2540	4822 124 41583	0.68 50
R3524	5322 111 90091	100 1/8	R3802	4822 111 90163	OE	C2541	4822 122 33147	0.022 50
R3530	4822 111 90543	47K 1/8	CAPACITORS			C2542	4822 122 33147	0.022 50
R3531	4822 111 90344	15K 1/8	C2501	4822 122 33147	0.022 50	C2543	4822 124 40196	220 16
R3533	5322 111 90268	5K1 1/8	C2502	4822 124 22027	47 10	C2544	4822 124 40196	220μ 16
R3534	4822 111 90197	220K 1/8	C2503	4822 122 33147	0.022 50	C2545	4822 122 33104	0.1 63
R3535	4822 116 53081	12K 3/5	C2504	4822 122 31727	470P 63	C2546	4822 122 33104	0.1 63
R3540	4822 116 52858	4E7 3/5	C2505	4822 124 22027	47 25	C2547	4822 122 33147	0.022 50
R3541	4822 111 90544	6K8 1/8	C2506	4822 122 33104	100NF 63	C2550	4822 121 51049	0.015 63
R3542	4822 111 90124	82 1/8	C2507	4822 122 31644	0.0022 63	C2551	4822 121 51225	18NF 63
R3543	4822 111 90544	6K8 1/8	C2508	5322 121 42491	0.047 100	C2560	4822 122 31784	0.0047 50
R3544	4822 111 30483	1 1/3	C2509	4822 122 31772	47P 50	C2561	4822 121 51252	0.047 100
R3545	4822 111 30483	1 1/3	C2510	4822 122 32442	0.01 50	C2562	5322 121 42661	0.033 63
R3550	4822 111 90248	2K2 1/8	C2511	4822 122 31746	0.001 50	C2563	4822 122 33104	100NF 63
R3551	4822 116 90417	15K 1/8	C2513	4822 121 42245	0.22 63	C2565	4822 122 32808	0.0012 50

■ TECHNICAL INFORMATION

Explanation on the CDM4 mini system and servo circuit for service engineers

1. System Configuration

1-1. Block Diagram Rough



2. Rough Explanation of the Functions of the CDM4 mini System Part.

2-1. Servo electronics CDM4 mini system.

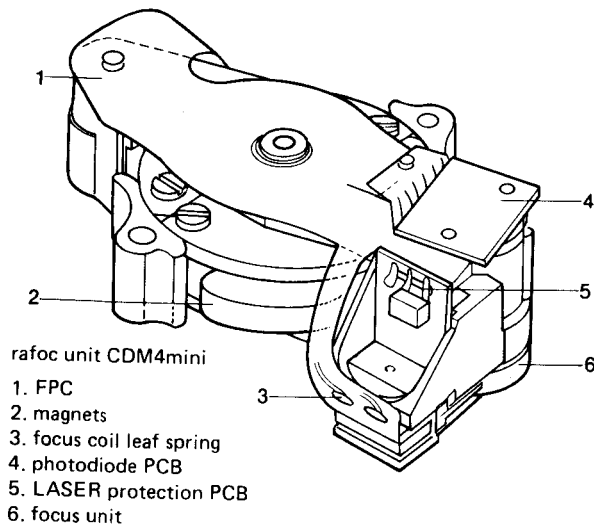
TDA8808: bipolar photo diode signal processor

- Photodiode signal preamplifiers with separate h.f. and d.c. a.g.c. for optimum generation of the h.f. data signal and the focusing/tracking error signals.
- Tracking error signal amplifier.
- Focus error signal processor with focus normalizing and start-up circuit.
- Data equalizer.
h.f. level and track-loss detectors.
- Regulated supply for the reading laser diode.
- Low current consumption: 15mA (8V - 14V).

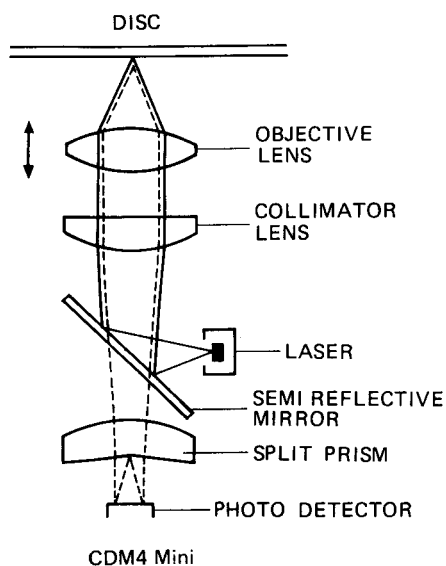
TDA8809: bipolar radial error processor

- Tracking error processor with automatic asymmetry control.
- a.g.c. circuitry with automatic start-up wobble generator.
- Tracking control for fast forward/reverse scan, search, repeat and pause functions.
- Low current consumption: 10mA (8V - 14V).

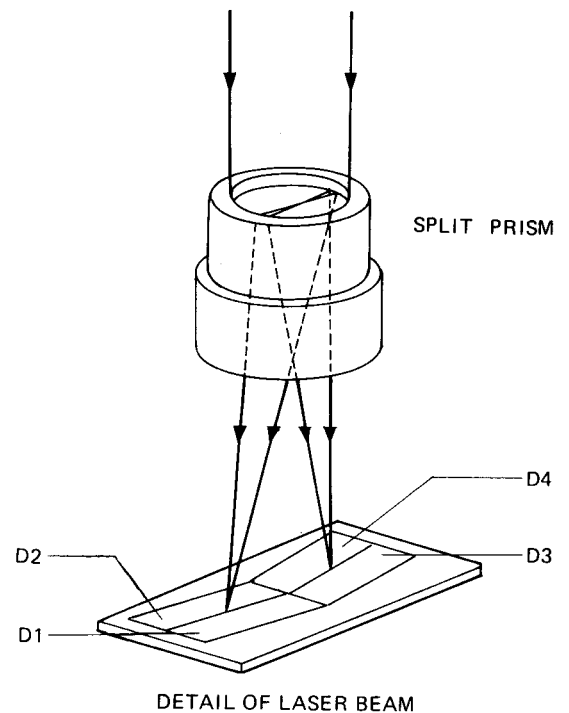
2-2.CDM4 mini Optical Pick-up



A feature of the CDM4 mini pick-up is its simple diffraction limited optics. The laser point source is focused on the information layer of the disc by two lenses: a spherical glass objective with a plastic aspherical skin, and a spherical glass collimator.



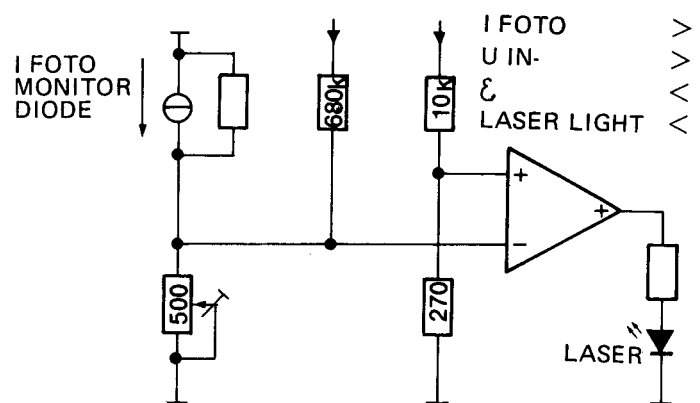
Furthermore, a semi-transparent mirror is used instead of a beam-splitter cube. Astigmatism introduced into the reflected beam by the mirror is corrected by a plastic component (the wedge) which also dissects the beam into the two halves from which the tracking and focus error signals are generated.



3.Detailed Explanation of the Functions in the Servo.

3-1-1 The LASER supply

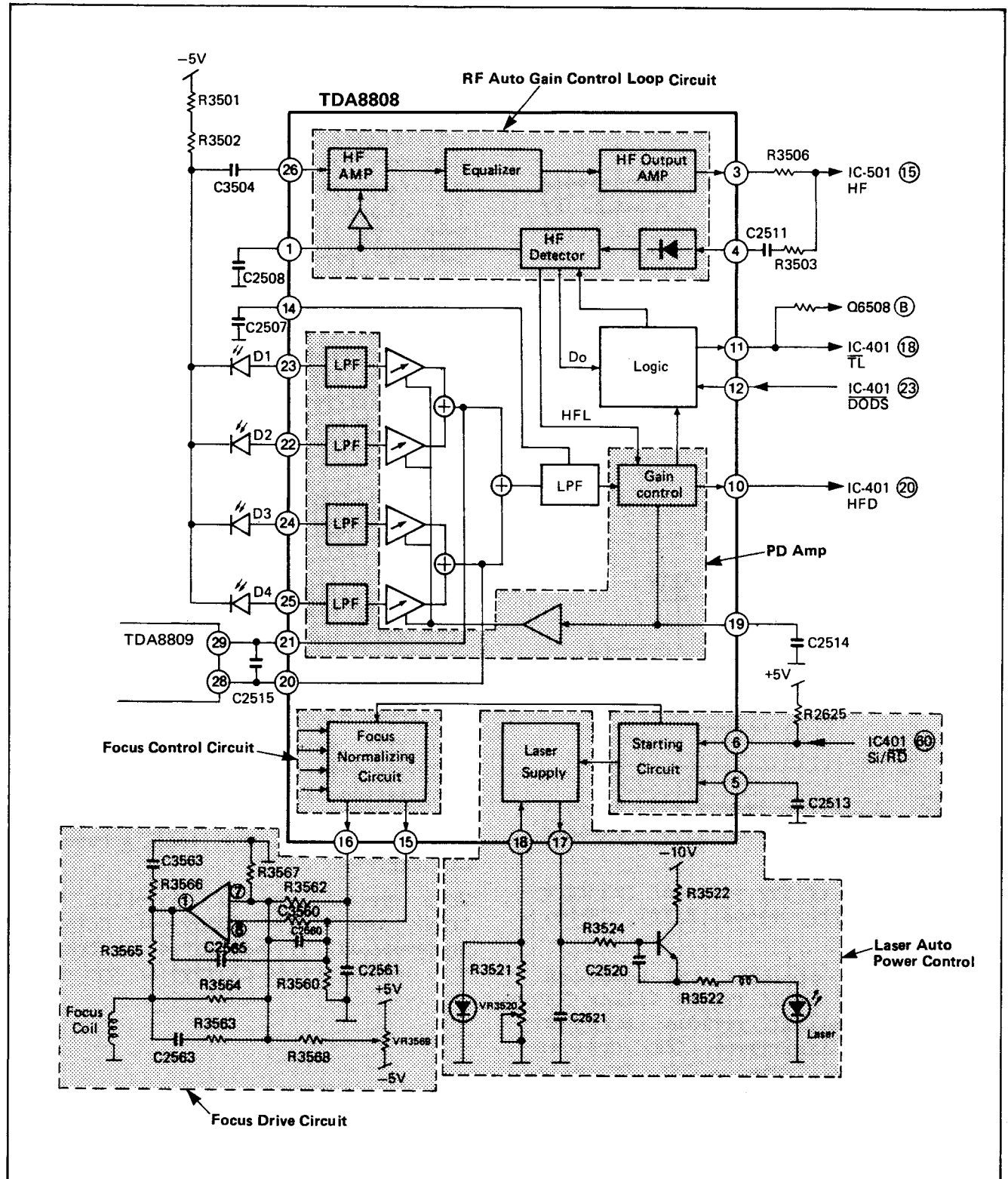
The LASER supply circuit has a working principle like the basic schematic below.



The LASER supply function integrated in the TDA8808 has as an extra an overload protection and a turn on transient protection. The LASER current is regulated by sensing the monitor photodiode current.

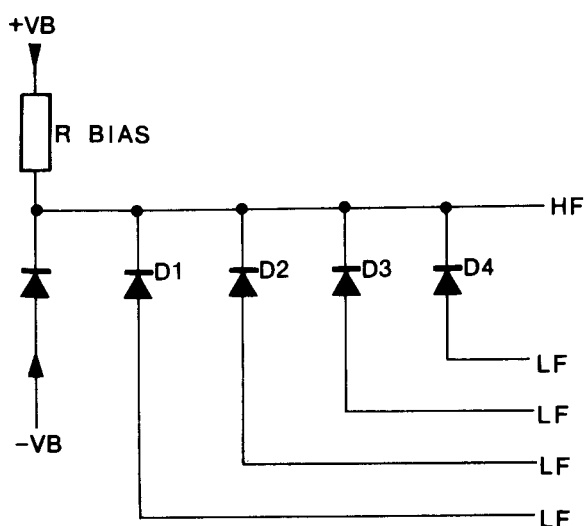
The threshold voltage of the LASER diode is approximately 1.75V and the sense voltage is approx. 200mV. It is not allowed to measure the sense voltage. A distortion at this end of the loop might cause severe damage to the LASER diode.

3-1-2 h.f. Signal handling, h.f. a.g.c.
and data equalizer.



The photodiodes used in the optical pick-up are connected in reverse direction. The photodiodes require a reverse bias of at least 5V. Bias current is set by R3501 and R3502. Supply noise and interference is kept away by R3501 and C2521. Coupling of the h.f. signal is performed by C2504, R3502 and C2521 also prevent h.f. coming into the supply.

The L.f. signal is effectively separated; from the L.f. signals by deriving the h.f. signal from the total substrate current of the four photodiodes and only the L.f. error signals from the individual anode currents. (see figure below).



The L.f. amplifier and a.g.c. circuit have to meet the correct transfer function.

The parameters of the transfer function are set by R3505, R3508, R3507, C2509, and C2508.

With internal girators the equalizer provides a 3rd order bessel filter for making the correct modular transfer function to compensate the optical pick-up system. The total IC bias current is set by the value of R3508 and decoupled by C2510. The girator circuits are set by the value of R3505.

The 3rd pole of the modular transfer function is made by the RC circuit containing R3507, C2511 and the capacitance of the h.f. wire from the CDM to the demodulator circuits.

3-1-3 The amplitude level detector

For the a.g.c. the amplitude of the h.f. signal is measured in a level detector by comparing a full-wave rectified and filtered version of the h.f. signal with an internal reference level. The level detector is not data path but parallel to the data path as in the CDM4 system. For fast response to drop-out the time constant of the high pass filter formed by R3507, C2511 and the detector input resistance has to be 10 sec. In the h.f. amplitude slicer the amplitude of the h.f. signal is sliced in 3 levels.

62% and below is HFD
12% and below is DO

The HFD output is used to switch the PLL on and off ensuring minimum locking loss while having a drop-out or during searching. This provides fast relocking afterwards.

Capacitor C2508 in combination with an internal switch provides a more constant gain control during drop-outs. The switch is operated by the HFD signal. This set-up restricts the h.f. signal and gives the loop a bandwidth of 50Hz.

When the pick-up is searching for a track the DODS (drop-out detection suppression) is activated to keep the h.f. signal level clamped on the normal

3-1-4 The photodiode current amplifiers and L.f. a.g.c.

The low pass filters for the photodiode inputs D1 - D4 are integrated in the photodiode signal processor.

The outputs for RE1 (RE1 = D1 + D2) and RE2 (RE2 = D3 + D4) are open collector outputs. In case an external pull-up has to be connected, it has to be connected to Vdd.

Normally the pull-up function is done by the inputs of the radial error processor.

The a.g.c. for the photodiode amplifiers keeps the d.c. sum current constant for all discs. The control loop has a LPF which is set by the value of C2507.

3-1-5 The track loss detector

During playback of a disc, the radial error signals keep the pick-up on track. In case of searching for a certain spot of music, the pick-up has to jump over the tracks. To maintain the control of the pick-up during a search operation, the microprocessor must be informed whether the pick-up is on track or off track. This function is performed by the track-loss detector.

Condition to be met for the track-loss:

- The gain controlled h.f. signal has to be between 12% and 62% of the nominal value (100% is set by the h.f. a.g.c.).
- Average light intensity of the I.f. signal is more than 120% of the nominal value (100% is set by the L.f.a.g.c.).

All values are set during track following.

Use of the TL signal:

- 1.Counting tracks when track jumping.
- 2.In case a TL is detected during normal playback the control microprocessor looks to the RE dig signal from the radial error processor and compensates the tracking error by means of the DAC signal.

Such a situation can only occur due to large knocks. This set up makes the system extremely tolerant for bumps.

(Formula $TL=FS>120\%$ and $63\%>HFL>12\%$).

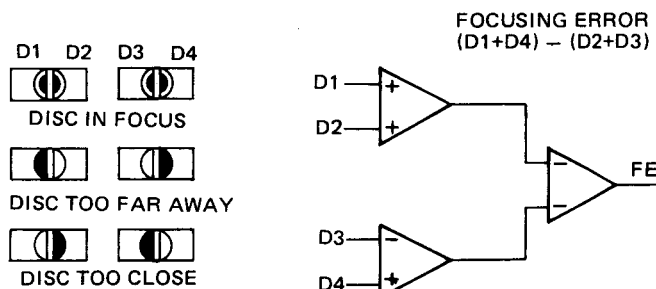
3-1-6 Focus processing

The CDM4 pick-up uses two focuault knife focus pick-ups to keep the reading spot focused on the data layer of the disc.

The TDA8808 has two focus outputs: FE and FE lag.

FE lag is the basic focus error signal. FE is a normalized version of FE to remove the effect of the unequal illumination of photodiode pairs D1, D2 and D3, D4 which occurs in case of tracking errors.

PRINCIPLE



$$FE \text{ lag} = (I1 + I4) - (I2 + I3) \cdot F_{\text{transfer}}$$

$$FE = \frac{I1 - I2}{I1 + I2} + \frac{I4 - I3}{I4 + I3} \cdot I \text{ control}$$

Since in focus $I1 + I2 \approx I3 + I4$

and $I1 \approx I2 \approx I3 \approx I4$ with a.g.c. on

$FE = FE \text{ lag on trace}$

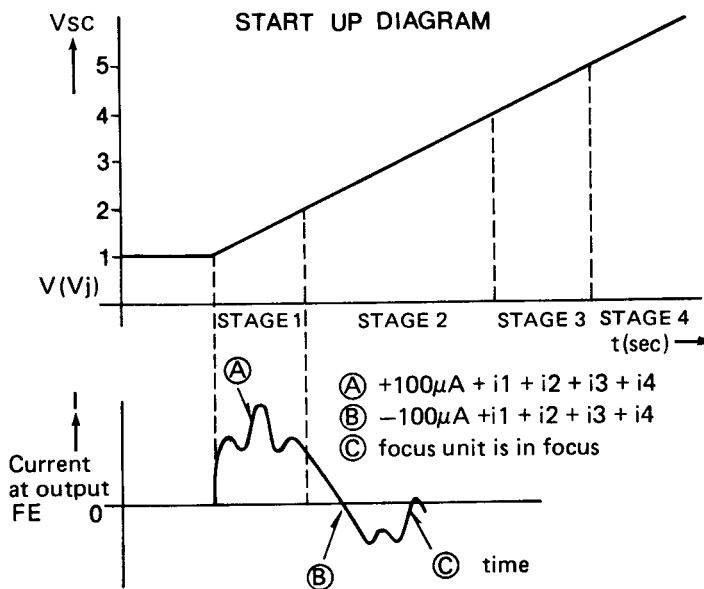
Either one signal or both signals can be used to control the focus actuator. The FE lag signal gives the loop the correct gain and phase margin. The FE signal has an important role in the start-up procedure.

3-1-7 Start-up procedure

The whole start-up procedure is sequenced by the voltage across capacitor C2513. Capacitor C2513 is charged by an internal current source of 1 μA nom.

Together with a starting capacitor of 270 nF, a starting-up time of approximately 0.3 sec. is reached.

The start-up procedure is divided in stages. The procedure is started by putting a logical low level at the Si/ $\overline{\text{RD}}$ input.



STAGE 1

Laser turns on and the objective is moved to the center of the disc. The turntable motor is switched on. The FE pin delivers a positive going starting current of 100 μA + the sum current ($i_1 + i_2 + i_3 + i_4$).

Note the L.f. a.g.c. does not see light, so max amplification.

STAGE 2

The starting current is reversed, gradually causing the objective to go down. This process is stopped when the starting current equals the amplified sum current ($i_1 + i_2 + i_3 + i_4$).

Note: $i_1 + i_2 + i_3 + i_4 = 100\mu\text{A}$

STAGE 3

A smooth transition is made from the amplified sum current ($i_1 + i_2 + i_3 + i_4$) to the normalized focus error signal

$$\frac{i_1 - i_2}{i_1 + i_2} + \frac{i_4 - i_3}{i_4 + i_3}$$

The spot is now almost focused on the reflective layer of the disc.

The signals to the FE pin.

STAGE 1 (starting-up current + $i_1 + i_2 + i_3 + i_4$)

STAGE 2 (starting-up current + $i_1 + i_2 + i_3 + i_4$)

Stage 3
$$\frac{i_1 - i_2}{i_1 + i_2} + \frac{i_4 - i_3}{i_4 + i_3}$$

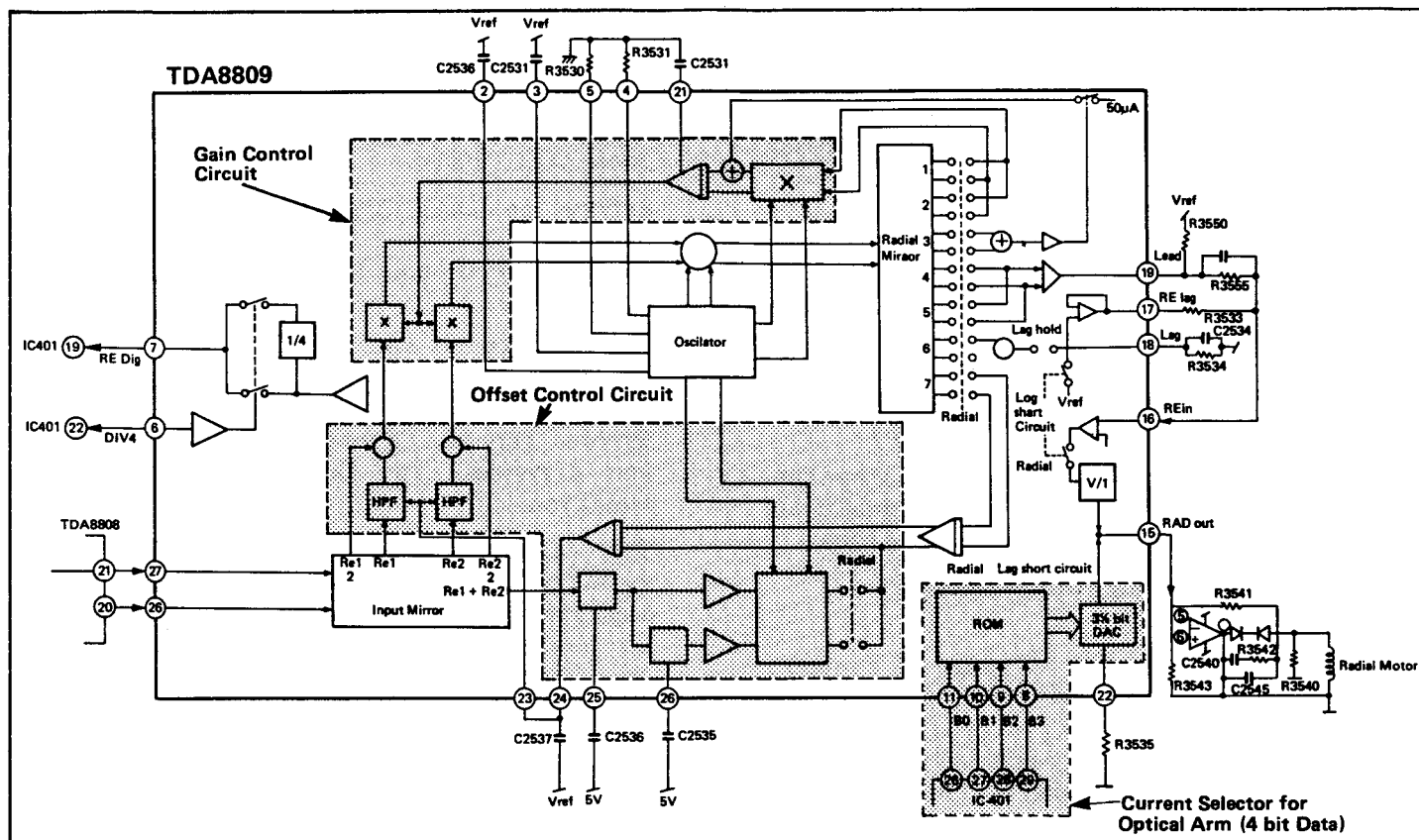
This should be almost 0

The signal to the FE lag pin.

Stage 4 $(i_1 + i_4) - (i_3 + i_2) + \text{the normalized FE (like in stage 3)}$

The arm is kept at the inside recess by means of a binary word from the microprocessor at B0, B1, B2, and B3 of the radial error processor.

3-2 TDA8809 RADIAL ERROR PROCESSOR



- The resistor R3535 sets the amount of output current of the DAC signal.
- The other components setting the oscillator frequency are R3530, R3531, C2530, C2531.
- The inputs B0 - B3 are used to control the operations which have to be performed by the radial error processor.
- The DAC output is a current source output used to move the radial arm. The normal control is RE, but to jump beyond tracks and to compensate bumps the DAC signal is used.
- The RE lag output gives the loop a more powerful control. This output is only activated during normal playback.
- The RE dig is a 1-bit quantized version of the RE signal. The function of RE dig is not in all sets the same. Below is the function in a audio player explained. If a TL occurs the microprocessor looks to RE dig, the value of RE dig indicates whether the microprocessor has to compensate for a right or left bump via DAC. The maximum hold range of RE is normally

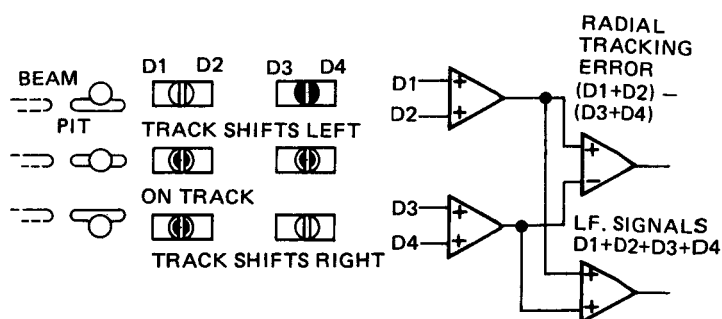
1/4 track pitch due to the sinusoidal form of the radial error signal. By means of TL and RE dig the hold range is extended to 3/4 track pitch.

- For high speed track crossing, four dived RE dig signal is given by pulling Div 4 input to low level.

3-2-1 Radial processing

The radial error processor has to process the basic input signals RE1 and RE2 and to generate the full radial error signal RE. The RE signal is the basic signal to keep the reading beam on track.

RE1 and RE2 are caused by more or less light of the laser falling onto diodes D1, D2 or D3, D4 (see figure below)



$$RE1 = i1+i2 \text{ and } RE2 = i3+i4$$

The processing formula produced by the radial error processor is $RE = k d (i1+i2+i3+i4) - k(i1+i2)$.

The factors k and d are detected from the loop itself by processing a low frequency wobble fault signal, which is injected into the loop. Injection of this causes a displacement of $\pm 0.05 \mu m$ of the arm.

The k is again factor and has to compensate:

- The tracking angle fault (varies between 90 degrees, smallest radius, and 45 degrees, largest radius).
- The pit geometry of disc (causing the amplitude of radial error signals to vary up to 100% from disc to disc).
- Deterioration of the laserdiode.

3-2-2 Automatic gain control (k-factor)

Detection of the desired value is done by detecting the phase angle of an injected wobble signal in the radial loop.

The closed loop transfer function has a phase shift of 135 degrees at 650 Hz (the wobble frequency).

To maintain the loop gain, the phase of the closed loop signal of RE is compared with a -45 degrees shifted signal derived from the 650 Hz wobble injection oscillator. If the gain is nominal the output of this phase comparator is zero. In other cases a positive or negative phase error signal is detected.

The detected signal is integrated by C2538. The value of this integrated signal sets the gain. This completes the set up for the k factor in TDA8809.

Note: The phase comparator is a linear multiplier which ensures that the a.g.c. loop is unaffected by spurious signals near the odd harmonics of the wobble frequency.

The open-loop gain control is clamped to an internal reference level during starting-up and searching.

3-2-3 Automatic asymmetry control (d-factor)

The radial error signal in a single-beam pick-up is derived from a comparison of the light intensity in each pupil half.

Errors in this signal can be caused by:

- Asymmetry in the far-field pattern of the laser.
- Light path to the disc.
- Imperfections in the beam splitter.

Errors can be corrected by bringing the d -factor in the total transfer function.

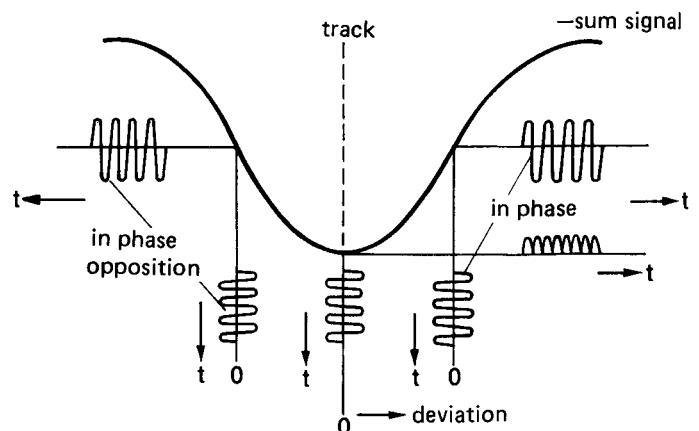
The wobble used to measure the k -factor is also used to measure the asymmetry. The signal causes the beam to wobble with an amplitude of $0.05 \mu m$. When the reading spot is to the right of the track the total amount of L.F. light ($i_{TOT} = i1+i2+i3+i4 = RE1 + RE2$) is in phase with the wobble in the radial error signal.

When the reading spot is to the left the I.f. sum signal ($RE1 + RE2$) is 180 degrees out of phase with the wobble.

The sum signal is in practice multiplied by a 90 degrees shifted version of the wobble signal. The multiplier is again linear giving the above-mentioned benefits. The loop has a filter which is set by the value of C2537.

The imperfections mentioned above make the beam follow the track at one of its edges. The wobble component in the RE signal for such a situation is visualised below.

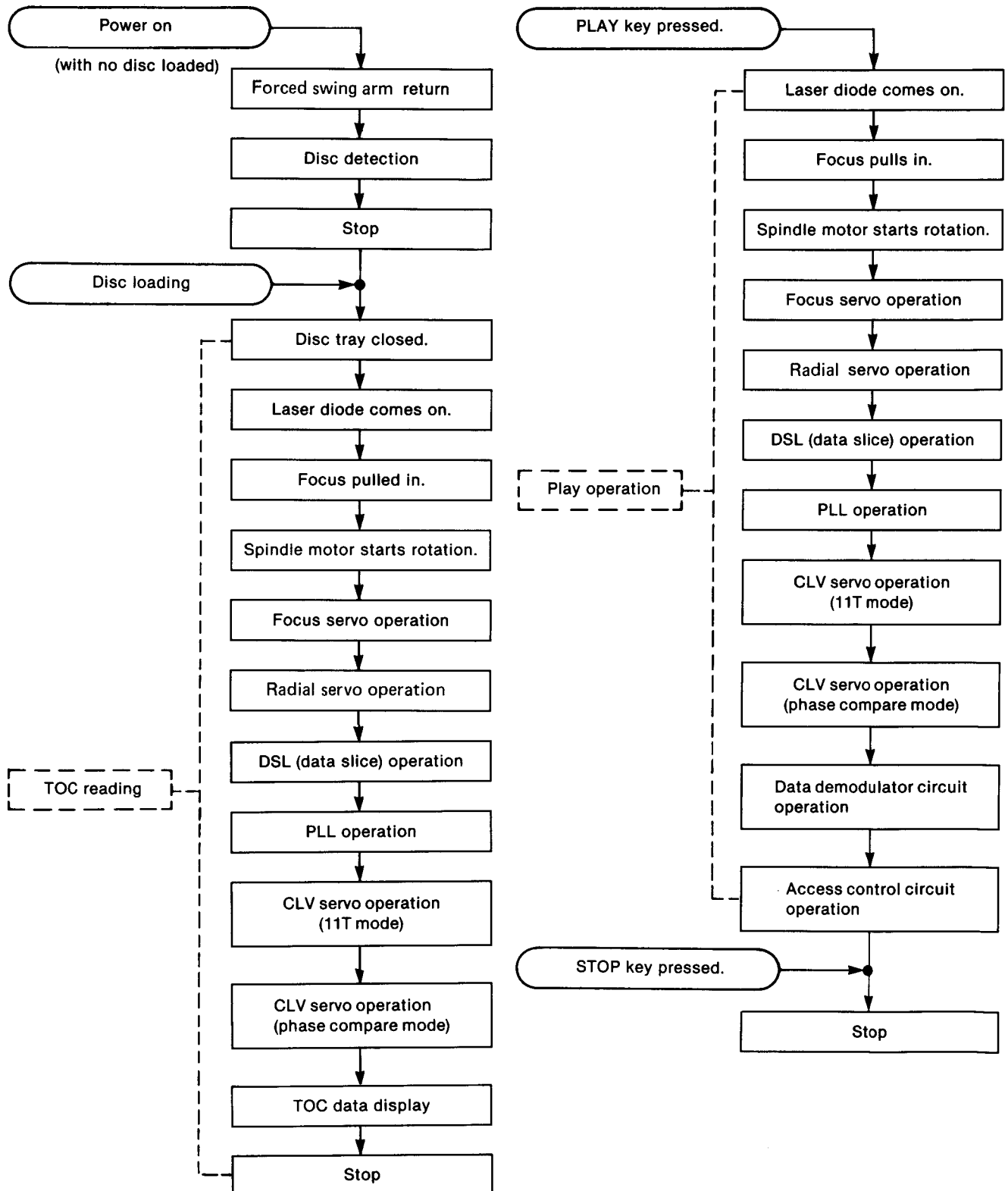
Note: C2537 is the capacitor which integrates the d -factor.



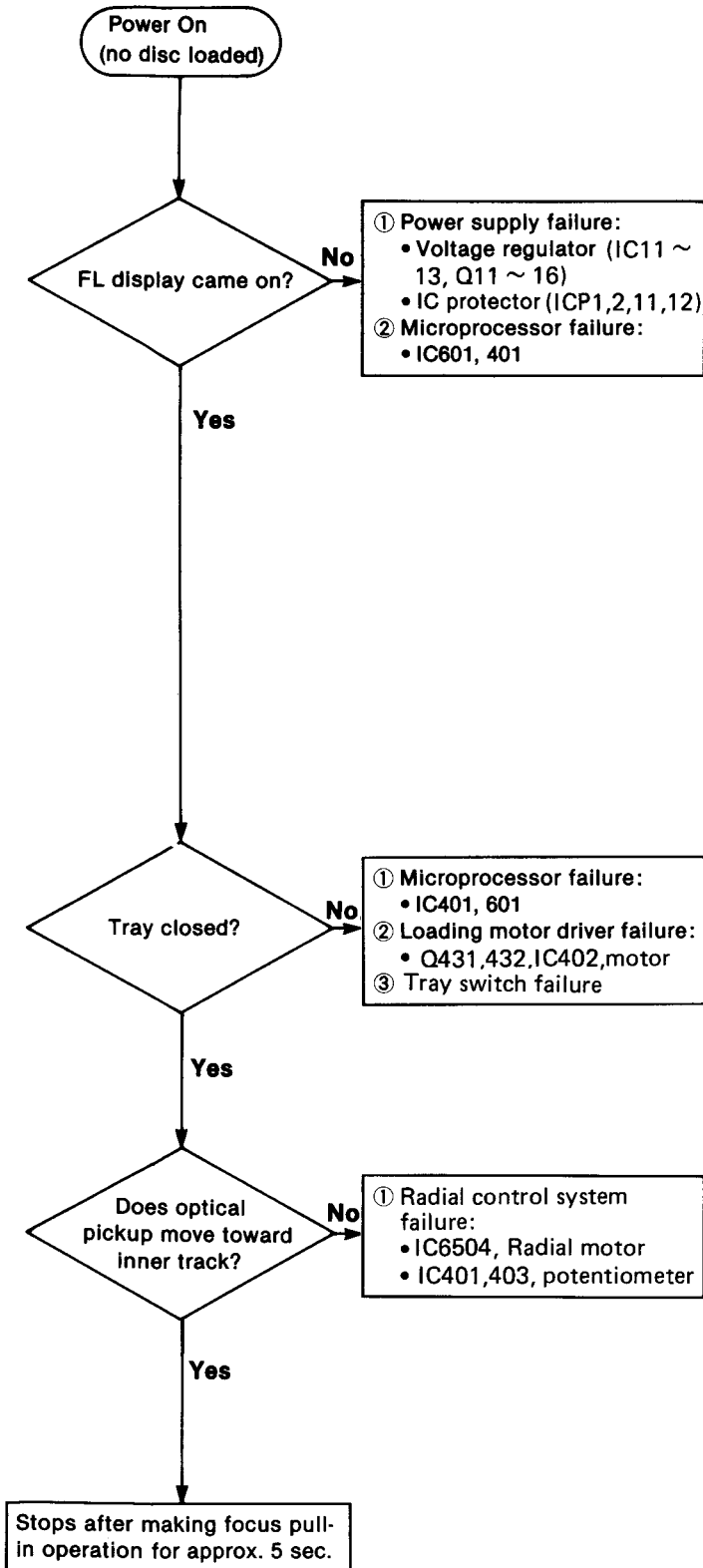
■ TROUBLESHOOTING GUIDE

SL-PJ24A Operation Sequence Check Sheet

Play Operation Sequence



(Operation Sequence Just After Power On)



(TOC Read Operation-PLAY Operation)

